



МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ  
Федеральное государственное автономное образовательное учреждение высшего образования

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**Школа естественных наук**



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### **Far East of Russia: natural conditions, resources, environmental problems**

Course purpose is to get acquainted with the natural conditions of the Far Eastern Federal District, with their diversity and contrast, as well as with the main resources, areas of their use, and environmental problems associated with the exploitation of these resources.

Course objectives: study of the relief and climate; water resources; use of water, forest and mineral resources; the quality of drinking and other natural waters; Protected areas

## **Environmental toxicology and chemistry**

Course purpose is acquaintance of students with the conceptual fundamentals of environmental chemistry as a modern complex science that studies chemical processes occurring in various geospheres of the Earth; the formation of ideas about the interconnectedness of natural physical, chemical and biological processes in various spheres of the Earth and the influence of human activity on them; acquaintance of students with the effects of exposure to toxic substances on organisms, populations, communities, and the ability of populations to adapt to anthropogenic pollution.

Course objectives: study of chemical processes occurring in the atmosphere, hydrosphere and lithosphere; study of the processes of migration and transformation of chemical compounds of natural and anthropogenic origin; consideration of problems arising in the process of anthropogenic environmental impact associated with pollution of atmospheric air, soil, surface and groundwater; development of skills for a scientifically based assessment of the quality of the environment and its changes under anthropogenic activities; development of theoretical knowledge in the field of molecular and ecological toxicology, toxicokinetic, toxicodynamic and toxicometry; study of the fate of chemicals in the environment and in food chains, with the impact on ecological toxicity of the properties of organisms and non-chemical stressors, with toxicity mechanisms, allowing to assess toxic damage at the level of organisms, populations and ecosystems.

## **Environmental Analytical Chemistry**

Course purpose is study of the main approaches to the analysis of natural objects – air, water, soil – on the main components and toxicant substances.

Course objectives: to study the theoretical basics of conducting a chemical experiment, the main analytical methods for studying chemical substances in environmental objects, and especially the use of analytical methods for analyzing environmental objects; apply basic analytical methods and methods of research of chemicals in environmental objects; to study the safety standards, their implementation in the laboratory during the analysis of environmental objects.

## **Control of natural water quality**

Course purpose is to acquaint with various organizations (production services and research institutes), which monitor the state of natural waters, methods used and monitored indicators. Control over water bodies is determined by the nature of their use by humans, and the level of control rigor is determined by environmental safety, human health and aquatic ecosystems.

Course objectives: to acquaint with the work of waterworks, the requirements for drinking water, and the methods by which the required level of water quality is achieved; to acquaint with the work of the Hydrometeorological Service, with the requirements imposed on water bodies of fisheries importance, both freshwater and marine, by methods of water analysis determined by indicators, methods of achieving the required quality show requirements for water bodies attributed to water bodies of categories I and II; acquaint with the nature of specific hydrochemical and biological observations of water bodies performed in scientific laboratories of universities and research institutes (hypoxia, acidification, microbial indication, etc.).

## **Microelements composition of marine organisms**

The microelement composition of organisms carries a wealth of information and is studied from different perspectives. It is important for a person who consumes seafood to know the content of various elements in marine food objects in order to have an idea about their safety and usefulness, about the wealth of specific elements. Trace elements found in the tissues of commercial fish, such as Pacific salmon, can serve as tracers for their feeding grounds and anadromous migration. A researcher who monitors environmental pollution by the content of elements (heavy metals) in accumulating indicator organisms can determine its quality and the degree of contamination with hazardous pollutants such as mercury, cadmium, lead, arsenic, etc.

Course purpose is to recognize the wealth of information carried by the trace element composition of marine organisms.

Course objectives: To be able to analyze tables with actual data on the content of microelements in different types of organisms - algae, mollusks, fish; Understand the meaning of the spatial distribution of trace elements in objects and the environmental information resulting from it; See what information different types of indicator organisms give, what organisms can be used as indicators; To find out what is chosen as reference points for comparative assessments - MPC, background characteristics, known water areas, etc.

## **Ecology of marine meiobenthos**

The course in marine meiobenthology is designed to educate in benthos skills in the diverse fields of research: link between the activities of meiofauna to ecosystem processes; assessing large-scale meiobenthic biodiversity patterns in temperate and tropical marine waters; marine meiofaunal taxonomy and ecology, with adding ecological and geographical information; training in identification of meiobenthos; information on meiobenthic distribution patterns (with emphasis on nematodes); assessing the role of anthropogenic drivers (e.g. various types of disturbance) for differences in large-scale meiobenthic distribution patterns; testing the performance of functional attributes of nematode assemblages in assessing the potential effects of anthropogenic and natural disturbances on benthic systems; feeding ecology of marine nematodes.

Ecology of marine meiobenthos course is mainly include experimental and fieldwork, taking advantage of the easy access to a wide range of coastal environments provided by FEFU location.



### **Biogeochemical provinces in the ocean**

Volcanism and upwelling, located in the western part of the Pacific, form impact zones with extreme natural geochemical conditions that affect marine organisms. Course purpose is to show the types and locations of biogeochemical provinces, as well as their influence on the trace element composition of organisms. Course objectives: to compare the levels of pollutant levels in organisms living and feeding in impact zones with MACs from different countries, as well as with organisms in other zones of the World Ocean.

## **Environmental monitoring**

The contents of the teaching materials on the course are based on modern science and educational practice and reflects the author's approach to the subject matter.

Discipline "Environmental monitoring" forms the theoretical and practical knowledge of ecology specialists in the field of integrated environmental monitoring of natural ecosystems and the methods assess the adverse effects on the environment.

## **Bioassay of the environment and waste**

The purpose of studying the discipline: obtaining basic knowledge of the scientific principles, methods and modern biotesting technologies.

Tasks: recognize the importance of the biotic concept of environmental assessment; get an idea of the possibilities of use and the main areas of application of bioassay; explore the main approaches and applications of bioassay; study of the features of the biological assessment of various environments (soil, water, atmospheric air) and waste.

Course description: Bioassay in biological monitoring. The history of bioassay. Theoretical bases of bioassay. Types of biotests. Requirements for the selection of test organisms. Biology and ecology of test organisms used for bioassay of fresh water and soil. Test-reactions. Comparison of the sensitivity of test organisms to model toxicants. Features of freshwater crustaceans, microalgae and infusoria laboratory cultivation. Methods of biotesting of sea waters and bottom sediments. Methods of collection, transportation, storage and preparation of samples for biotesting. Processing the results of biotesting. The main parameters for assessing the toxicity of pollutants: LC, EC. Dose-effect relationship. Calculation of effective and lethal concentrations using graphical and computational methods. Determination of toxicity and hazard class of waste based on bioassay results.

### **Measuring and monitoring of the biodiversity**

The purpose of mastering the discipline is to get students the theoretical knowledge and practical skills of quantitative assessment of biodiversity (BD).

The objectives of the discipline: Obtaining knowledge about the evolution of biological diversity, its current level and status, key factors affecting its dynamics, methods for measuring and monitoring BD; Practical application of BD measurement methods for solving various problems in the design, expert and analytical and research activities; Strengthening the skills of independent use of methods for measuring and monitoring the BR for solving research and production and technological problems.

## **Monitoring of harmful algal bloom of the Russian seas**

The purpose of mastering the discipline is to get students the theoretical knowledge and practical skills of Harmful microalgal monitoring and biotoxicity.

The objectives of the discipline: Introduction to biodiversity of marine microalgae; Harmful Algal Blooms and Toxins – The Problem, Causes, Examples of the range of impacts and their potential seriousness; Serious economic impacts of harmful algal blooms (HABs) on fisheries and cause harm to people's health in countries of the PICES region, including the northern Russian Pacific region; Natural phytotoxins: sources, classification (PSP, DSP, ASP, NSP, Siguatera) toxins, toxic and pharmacological effects; Chemical structures, properties, and biosynthesis, source in nature, mechanism of action, illness and poisoning; Features Monitoring of Harmful Algal Blooms and Biotoxicity of Russian Far Eastern Coastal Waters.

The course consists of practical training and laboratory experiments. After a short introduction in taxonomy of toxin producing harmful algae the chemistry and chemical methods for quantitative and qualitative determination of algal toxins is given. The content of the teaching materials on the course is based on modern science and educational practice.

## **Deep Sea Ecosystems**

Course purpose is to give an idea of the organisms living in the depths of the Pacific and the methods for their assessment. Course objectives: to study deep-sea species and their ecology; study equipment for the study of the sea depths; study the composition of the Pacific Ocean deep-sea fauna

## **Fish resources and aquaculture**

The purpose of mastering the discipline: to give an idea about the possibilities of practical use of the fish resources of the Far Eastern seas, as well as about the structure, functioning and results of the work of fish farms in the Far East of Russia.

Objectives of the discipline: to acquaint students with the regional conditions of existence of the main groups of hydrobionts, their qualitative composition and the possibility of using fish resources for practical purposes; provide an opportunity to assess the artificial reproduction of salmon in the Far Eastern regions, as an important component in the conservation of fish resources.

The name of the discipline sections: General characteristics of the marine economic zone of the Far Eastern region of Russia; Fish resources of the Far Eastern region, their practical use; Artificial reproduction of Pacific salmon as an essential tool in preserving the fish resources of the region; The history and current state of the existing fish farm of the Far East; Some environmental and biotechnical features of artificial reproduction of salmon in the Far East; Commodity and pasture fish farming in the inland freshwater bodies and streams of the region; Development prospects and problems of aquaculture of the Far East.

## **National resources of Russia: problems of domestic, foreign policy and rational use of aquatic biological resources**

Discipline is devoted to the modern analysis of various aspects of domestic and foreign trade policies of the state with respect to aquatic biological resources, taking into account their rational use. Environmental, economic, legal and administrative tools that could contribute to the effective functioning of the extractive industries of the national economy, the rational use of aquatic biological resources, increased global competitiveness, and the optimization of domestic and foreign trade are discussed.

Special attention is paid to the functioning of the fishing industry, analysis of methods and instruments of state regulation, including foreign trade in aquatic biological resources, regulatory issues, regulation of international and national circulation of rare and endangered aquatic biological resources, protection of rare and endangered aquatic biological resources from the goal of biodiversity conservation. The purpose of the discipline is to identify the main problems, trends, peculiarities of the domestic and foreign trade policies of Russia with regard to the rational use of aquatic biological resources in the context of globalization, to identify contradictions and possible ways to resolve them to preserve biodiversity, protect rare and endangered species of aquatic biological resources.

The objectives of the discipline are: To form students' knowledge about the main directions of the state's foreign trade policy regarding aquatic biological resources; To characterize the legal basis of foreign trade regulation and rational use. Systematize and deepen knowledge regarding the rational use of aquatic biological resources as an object of domestic and foreign trade; To study the issues of regulatory support and regulation of the international and national circulation of rare and endangered species of aquatic biological resources.



## **Marine ecosystems – biota, ecological factors, productivity**

The purpose of this lecture course is to develop competencies in understanding the structure and functioning of various types of marine ecosystems in order to develop evidence-based approaches to the management and rational use of marine resources. The objectives of this course include consideration of the main components of the marine ecosystems of the following types - littoral, shelf and deep-sea, consideration of the climatic features of their functioning (from tropical shallow water to cold-water areas of the ocean), as well as interrelations between the components of these ecosystems (bionomic, trophic, biochemical, etc.).

## **Deoxygenation and acidification of the World Ocean**

The goal: To give for students a current state about a global change occurring in the World Ocean with focus on deoxygenation and acidification.

It is given the imagination about the global changes which occurrence on the Earth - global warming, increasing of concentration of the green-house gases in atmosphere with focus on “Keeling curve”. It is given the adumbration about global changes in an open World Ocean and its shelf as well. It is demonstrated roles of natural and anthropogenic factors causing global changes in the World Ocean. It is given the representation about methods for establishment of the deoxygenation and acidification of the Sea of Japan. I am demonstrated the ecological consequences of the deoxygenation and acidification of the World Ocean.

There are many independent evidences about occurrence of global changes of the World Ocean. Deoxygenation and acidification are such changes. These changes worry mankind since they can lead to irreversible changes in the ecosystem of the World Ocean. The global changes which occurred on the Earth, such as the global warming, increasing of concentration of the green-house gases in atmosphere with focus on “Keeling curve” will be presented. The adumbration about global changes in an open World Ocean and its shelf as well will be given. The role of natural and anthropogenic factors causing global changes in the World Ocean will be demonstrated. It will give guide to methods for establishment of the deoxygenation and acidification of the Sea of Japan. These methods will include modern practices and theory of carbonate system in ocean. Finally, the deoxygenation and acidification of the Japan Sea and its shelf (the Peter the Great Bay) will be presented.

### **Final qualifying work (master's dissertation) (MD)**

MD topics will be focused on solving one of the research tasks most relevant to scientific partners.

The work will contain a detailed study of literary sources, scientific foundations, methodological principles. Work is the final nature of training in the direction of training. For the implementation of WRC, all knowledge and skills obtained in the process of studying the curriculum of an educational program are required.