UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Freshwater Ecology

2526-1-F7503Q013

Aims

The course aims to bring the student to:

- examine in depth knowledge about chemical-physical, chemical, biological characteristics of aquatic ecosystems;

- examine in depth knowledge about ecological principles at the base of the functionality of inland water systems (both natural and anthropogenic);

- examine in depth knowledge about the interconnections between the different aquatic compartment;

- know different anthropic impacts that alter the environmental quality and recovery techniques.

At the end of the course the student will be able to:

- measure and evaluate, in different aquatic environments, the ecological functionality, the different anthropic impacts, and environmental quality;

- apply the main methodologies for assessing the environmental quality of aquatic environments and to prepare possible recovery interventions;

- make bibliographic research, read and learn skills from scientific articles and technical reports;

- plan a research project and a scientific experiment.

After completing the final exam, the student will have acquired adequate autonomy for:

- to critically address the main theoretical and applicative problems of assessment and management of aquatic environments;

- evaluate critically scientific aspects and contribute to the development of research.

Contents

Artificial water cycle.

River basins and river-lake network.

Interconnections among aquatic compartments.

Study of inland waters: natural and artificial lotic and lentic environments. Formation, morphology, evolution, chemist, biogeochemical cycles.

Sampling techniques, sampled and data analysis.

Biological communities, food webs and energy transfer.

The functionality of different aquatic systems.

Biological and functional indicators and indexes.

Anthropic alterations and impacts on aquatic systems.

Evaluation of environmental quality and alterations, quality recovery techniques.

Techniques for planning research projects and setting up experiments.

Detailed program

Lessons

Introduction to the study of inland waters: lotic and lentic environments.

Preparatory knowlegde.

River basins and river-lake network.

Physiography of lakes: origin, evolution, properties, habitat, morphometry.

Hydrological balance and renewal time.

Transmission of light and heat in lakes, stratification, vertical and horizontal movements.

Thermal dynamics of lakes, vertical distribution of dissolved gases, nutrients and main ions.

Phytoplanktonic, zooplanktonic, benthic, vegetable and fish communities (structures, population dynamics, sampling techniques, counting and analysis).

Analysis of food webs. Use of stable isotopes for the reconstruction of food webs: problems and perspectives.

Productivity, trophic level of lakes and their evolution (also through paleolimnological techniques); quality of the lakes.

Effects of climate change and anthropogenic impacts on lakes (eutrophication, hypolimnic oxygen deplation, potentially toxic cyanobacteria blooms, invasion of alien species, inorganic and organic pollution). Internal water contamination problems. Methods for defining the quality status of inland waters.

Study of deep sub-alpine lakes, small lakes in northern Italy and other significant lakes in the world.

Techniques for the recovery of lake quality (potential, advantages and disadvantages, effectiveness): hypolimnic aeration, phytodepuration and lagooning, diversion of discharges, liming, other techniques of nutrient reduction, biomanipulation of food webs.

Potabilization of lake waters.

Physiography of running waters: characterization and classification. Hydrology and fluvial morphology.

Functional organization of lotic systems: energy and organic matter; indigenous and allochthonous energy inputs; trophic-functional groups; River Continuum Concept; nutrient spiraling; Flood Pulse Concept; hierarchical organization of river systems.

The biological communities of lotic waters. Adaptations to running waters. Colonization, movements and recolonizations of running waters.

Anthropic impacts: alterations of chemistry, morphology, hydrology, biological communities.

Minimum vital flow and ecological flow. Biological indicators and biotic indices (IBE, STAR-ICIM). River Functional Indexes.

Techniques for recovering the quality of running waters, morphological diversity, hydrological conditions and biodiversity.

Aquatic environments of anthropic origin: springs ('fontanili'), dam and quarry lakes.

Laboratory

Microscopic classification of organisms belonging to phytoplankton, zooplankton and macrobenton. Biotic indexes, lake productivity evaluation. Statistical analysis of fish population.

Field excursion

Excursions on river and lake for observation of environmental quality recovery situations, application of sampling techniques, sampling that will then be analyzed in the laboratory.

During the teaching activities, the students will be involved in learning techniques for planning a research project and an experiment. They will also be guided in the study of scientific articles and technical reports.

Prerequisites

Knowledge of general and inorganic chemistry (properties of water; acids, bases, and salts; equilibrium reactions; gas law; carbonate balance; redox potential; stable and unstable isotopes). Hydrogeological cycle. Knowledge of biogeochemical cycles of nitrogen, phosphorus, and silicon. Knowledge of general and systematic zoology.

Knowledge of general ecology.

Teaching form

-16 of two-hour lectures, in person, Delivered DidacticsLesson (4 cfu)

-1 of two-hour lab activities and 1 of three-hour lab activities, in person, Interactive Teaching Laboratory (0.5 cfu)

- 2 of field activity (7.5-hours each one), in person, Interactive Teaching (1.5 cfu)

Textbook and teaching resource

Teaching material provided by the professor (published on e-learning).

Suggested books:

- Spiro T.G. and Stigliani W.M. 2003. Chemistry of the Environment. Pearson Education.

- Walter K., Dodds and Matt R. Whiles: Freshwater Ecology, Elsevier Publishing.

- Bertoni R. 2006. Laghi e scienza. Introduzione alla limnologia. Aracne Editrice.

- Fenoglio S. e Bo T. Lineamenti di Ecologia Fluviale. Hoepli Editrice.

Semester

Second semester: March 2024 - June 2024

Assessment method

Oral examination concerning the topics treated in the Lessons, laboratory and field experiences.
There are no intermediate tests.

The purpose of the exam is to verify the acquired competencies, the ability to create connections between the different topics studied, the ability to integrate that has been read in the scientific articles with the basic knowledge. The explain capacity and the language style will also be evaluated.

Office hours

By e-mail appointment

Sustainable Development Goals

CLEAN WATER AND SANITATION | RESPONSIBLE CONSUMPTION AND PRODUCTION | CLIMATE ACTION | LIFE BELOW WATER