UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Underwater Scientific Methodologies for Ecological Studies and Monitoring

2425-2-F7502Q047

Aims

The course includes both theoretical lessons and practical exercises conducted in the field/ swimming pool, and it is designed to train students to acquire the basic skills necessary for the use of underwater sampling and monitoring techniques in the field of Marine Ecology. The course will also include advanced SCUBA dive planning, with particular emphasis on safety and efficiency.

Contents

The course analyzes the main techniques for studying and monitoring the coastal marine environment through SCUBA diving. In particular, by using both a theoretical and practical approach, the course addresses the following topics: underwater anatomy and physiology, underwater SCUBA systems, diving techniques, characterization and peculiarities of scientific diving, underwater navigation and detection, and scientific sampling techniques.
Theoretical lessons include diving planning with air, Nitrox breathing gas mixes, sampling methodologies, statistical data analysis, scientific diving principles, and case studies. Practical and theoretical notions also concern accident prevention and rescue through CPR (cardio-pulmonary resuscitation) and underwater rescue techniques. Underwater navigation exercises, visual census techniques (transects and quadrats), and survey simulations to be carried out in the swimming pool as preparation for the sampling activities that students may subsequently/eventually perform directly in the field. Practical activities require the development of strong interaction and coordination skills within a working group, which will represent another aspect that will be covered during the course.
By the end of the course, the student will be able to identify and apply the most appropriate underwater biological detection and sampling techniques in relation to specific research activities, monitoring or conservation plans, and ability of technical/physical problems management.

*__The course will end with one or two dives in the sea/swimming pool by using transects for the collection__

of ecological data of benthic organisms.
The dives in the sea will be subject to weather and environmental conditions

Detailed program

Theory:

- Underwater Anatomy and Physiology: understand the human body's response to SCUBA diving
- Diving equipment: breathing systems and the use of gas mixtures; protection systems and cold-water diving; communication systems; and transport systems.
- The history of scientific diving
- Applications and limitations of scientific diving
- Destructive underwater sampling techniques: scratches, panels, sorbonne, nets, traps.
- Non-destructive underwater sampling techniques: roving diving, squares, transects, video and photographic surveys, visual-census techniques.
- Sampling preserving and processing for different biological analyses
- Developing a scientific perspective and fostering respect for the underwater world
- Tropical and Mediterranean coral diversity
- Ecological restoration: different techniques for restoring marine ecosystem
- Introduction to data processing for the different underwater sampling techniques, such as software for photomosaic and statistical analyses.

Practical exercises
The course will be integrated with practical activities and exercises carried out by SCUBA diving. In particular, the following activities will be trained:

- Buddy team system: practice for safety and efficiency;
- Basic diving equipment assessment and maintenance
- Peak performance buoyancy: a technique to control buoyancy effectively;
- Underwater and surface navigation techniques with the use of compass and efficient search and recovery routes;
- Transects for surveys of known surfaces, with the use of metric lines and quadrats.
- Band transects to access organisms' density
- • Point intercept transects
- • Use of underwater sampling grids for spatial distribution of species
- • Underwater sample collection
- • Underwater video documentation of marine habitats
- • Underwater photomosaics
- Develop knowledge and familiarity with scientific diving practices applied to marine ecology
- Use of the lift-bags***
- Cardiopulmonary resuscitation techniques (CPR).***
- Prevention of diving accidents and underwater rescue: training for prevention and techniques for responding to diving accidents;
- Realization of a project in the sea, statistical analysis of the data, and presentation of a final scientific report: implementing the techniques learned through a field research project to collect data and perform statistical analysis to interpret the findings; compilation of a final scientific report to present including introduction, methodologies, result and discussion, conclusions. This will provide students with hands-on experience in conducting scientific research, data analysis, and scientific communication.

*****subject to material and time availability

Prerequisites

It is mandatory for the student to meet the following pre-requisites before enrolling in the course:

- basic knowledge of zoology, ecology, and marine biology.
- a first-level diving certificate issued by any internationally recognized diving teaching agency (e.g. CMAS, PADI, SSI) with a minimum of 20 logged dives,
- a valid medical certificate of suitability for SCUBA diving, issued by sports medicine or a hyperbaric medicine center,
- possession of own personal snorkeling equipment (5 mm wetsuit, boots, fins, weight belt, weights, mask, and snorkel) and SCUBA diving equipment (5 mm wetsuit, boots, fins, BCD, regulators, diving computer, weight belt, weights, mask, and snorkel),
- a diving insurance (DAN or similar),
- to be independent with transportation, since most of the activities will take place out of the University
  Regarding field activities (Campus Aborad activities), each student must have the possibility to independently reach the location where activities will be carried out and a small contribution from the students, to cover course expenses, might be required.
  Attendance of field activities is mandatory.

Teaching form

7 two-hour lectures, in person, Delivered Didactics
12 four-hour field activities, in person, Interactive Teaching

Textbook and teaching resource

Equipment provided for personal use to each student:

- material for underwater surveys / transects.
- Guidelines: the techniques taught follow the AAUS guidelines (American Academy of Underwater Science).

Additional materials in the form of protocols or publications will be available and downloadable online

Semester

second semester

Assessment method

The exam consists in the planning of a sampling design, the realization or simulation of an underwater sampling in the sea/swimming pool, and the realization of a final scientific report of the underwater activities****. As for the theoretical part, the student must demonstrate that he/she has acquired the basic knowledge illustrated during the course; as regards the practical part, the student will be asked to conceptually apply the methods learned in the

field to specific case studies.
The final grade is awarded out of thirty. The exam is passed when the grade is greater than or equal to 18. The highest marks with honors (30 with honors) are awarded.

****only if several conditions in terms of budget, minimum number of participants, weather conditions and certificate/permission will be satisfied

Office hours

Monday 8:30 - 10:30

Sustainable Development Goals

LIFE BELOW WATER