UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

BIOACOUSTICS

Enrollment year	2019/2020
Academic year	2019/2020
Regulations	DM270
Academic discipline	BIO/05 (ZOOLOGY)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	EXPERIMENTAL AND APPLIED BIOLOGY
Curriculum	Biologia ambientale e biodiversità
Year of study	1°
Period	2nd semester (01/03/2020 - 14/06/2020)
ECTS	6
Lesson hours	48 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	PAVAN GIANNI (titolare) - 6 ECTS
Prerequisites	No special prerequisites are required, however, a good zoological preparation with knowledge of ethology and acoustics facilitate learning. Since it is a highly interdisciplinary subject with a technological and IT component, it is useful to have an open approach to information of different nature and have a minimal predisposition to the technological aspects that are essential. The course also presents itself as an opportunity for students to participate in other degree courses such as physics, mathematics, oceanography, and electronic engineering.
Learning outcomes	Knowledge of bioacoustics and ecoacoustics, both for the theoretical and applicative aspects regarding the conservation and sustainability of anthropic actions (Agenda 2030 Objectives 4, 14, 15) both in marine and terrestrial environments, also considering the problems of climate change.

	Knowledge of communication and echolocation behavior in animals, knowledge of environmental acoustics, knowledge of the impact of anthropogenic noise on animals and the environment, knowledge of operational tools for research and environmental monitoring, knowledge of acoustics issues related to conservation and management of the natural environment and fauna. Enhancement of the acoustic environment and soundscape for tourism and educational purposes within the Green Economy framework. Knowledge of communication and echolocation behavior in animals, knowledge of environmental acoustics, knowledge of the impact of anthropogenic noise on animals and the environment, knowledge of operational tools for research and environmental monitoring, knowledge of acoustics issues related to conservation and management of the natural environment and fauna. Enhancement of the acoustic environment and soundscape for tourism and education.
Course contents	The course is aimed at deepening knowledge on animal behavior, on acoustic communication both in terrestrial and aquatic environments, as well as on environmental acoustic monitoring systems that can be used both for research purposes and for control and protection of the environment, especially in the marine bioacoustics sector with studies on marine mammals. Combining Bioacoustics and Ecology, ecoacoustics is illustrated, a new, rapidly developing discipline that connects to the sustainability themes and objectives of Agenda 2030, in particular for themes 4 (education), 14 (aquatic environment) and 15 (terrestrial environment). Acoustic environment and soundscape are also seen as a function of anthropic interactions within both the Blue Economy and the Green Economy. Acoustic communication systems are studied in all animal classes, echolocation in mammals (bats and cetaceans), acoustic and vibrational perception skills in animals, outlining specific scientific problems and the most innovative research lines. At the end of a classic treatment of bioacoustics we examine aspects of ecocoustics such as acoustic biodiversity, the acoustic environment and the soundscape, as well as and noise pollution. The course therefore deals with the technical problems related to the reception, recording, analysis and measurement of sounds (from infrasound to ultrasound, also including substrate vibrations), with particular attention to the most modern digital systems, but without neglecting a historical vision of evolution of instruments from the analog to the digital world. The course concludes with the application aspects of bioacoustics such as zoological studies, censuses, environmental monitoring, human-animal interactions, ethopharmacology and neuroscience, robotics, noise pollution, also considering the necessary software and an introduction to programming-based analysis techniques in R and Python environment. Complementing the theoretical lessons, tools for recording and analyzing sounds are tested both in the laboratory and in the field. The course is integrated by lectures and seminars by external scholars as well as by exercises for the use of tools, both hardware and software.Acoustic communication systems are studied in all animal classes, echolocation in mammals (bats and cetaceans), acoustic and vibrational perception skills in animals, outlining specific scientific problems and the most innovative research lines. At the end of a classic

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Teaching methods	lessons with powerpoint slides, videos and sound recordings support demonstrations of the use of software and tools for recording and analyzing sounds access to specialist websites references to scientific literature in English seminars of external experts on specialist topics (bats, noise measurement and control)
Reccomended or required readings	Obrist M.K., Pavan G., Sueur J., Riede K., Llusia D. & Márquez R., 2010. Bioacoustic approaches in biodiversity inventories. In: Manual on Field Recording Techniques and Protocols for All Taxa Biodiversity Inventories, Abc Taxa, Vol. 8: 68-99. The text can be downloaded here: http://www.abctaxa.be/volumes/volume-8-manual-atbi/volumes/volume-8-manual-atbi/chapter-5/Chapter-5.pdf

	170) Pavan G., 2015. Bioacustica e Ecologia acustica. Cap. 18. Pag 803-828. In: Renato Spagnolo (a cura di), “ACUSTICA. Fondamenti e applicazioni”, UTET Università, Torino 2015, 1-1582. Bradley D.L., Stern R., 2008. Underwater sound and the marine mammal acoustic environment. Guide to fundamental principles. US MMC: 1-67. The text can be downloaded here: http://www.mmc.gov/reports/workshop/pdf/sound_bklet.pdf Other lectures are suggested on the web page at http://www.unipv.it/cibra/edu_book_uk.html
Assessment methods	Oral examination. It takes place in a colloquial way, starts with some specific questions and requires to present some topics of the course in an interdisciplinary way.
Further information	The course deals with a highly interdisciplinary subject that can be of great interest for other degrees students, such as engineers, physicists, oceanographers, mathematicians. Interdisciplinary these are offered.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile