

Bioacoustic research...

...for nature conservation...

The Centro Interdisciplinare di Bioacustica e Ricerche Ambientali (Interdisciplinary Centre for Bioacoustics and Environmental Research or CIBRA) was created in 1988 within the Department of Animal Biology (Faculty of Nature, Mathematic and Physic Sciences) of the University of Pavia to foster the development of innovative bioacoustic research and applications.

Since its creation it has been endowed with a Laboratory of Marine Mammals Acoustics and Acoustical Oceanography focused on the emerging issues of the impact of human activities on marine mammals. In recent years, CIBRA become more and more involved in international research programmes concerned with the design of mitigation protocols and tools to reduce the impact of anthropogenic noise on marine mammals and, more recently, on the conservation of terrestrial soundscapes.

The core of CIBRA activity focuses on the acoustic communication in animals, the development of equipment and protocols for the monitoring and censusing of animals with passive acoustics (biodiversity monitoring), the development of advanced analysis methods based on the digital processing of signals, the establishment of a Digital Sound Library of Mediterranean Cetaceans, as well as the technical support to national and international institutions involved in bioacoustics and marine mammals research and conservation.

Since 2006, CIBRA has hosted a course (six credits) on Terrestrial and Marine Bioacoustics, which is unique in Italy.



Marine mammal acoustics and acoustical oceanography

Field activities to study marine mammals by using passive acoustics began in 1991 with a research cruise in the Aeolian Islands aimed at testing new equipment developed at CIBRA for recording the presence of marine mammals. Then interests evolved to more comprehensive research topics such as environment use, identification of critical habitats, and analysis of the impact of human activities on marine mammals (ship traffic, chemical pollution, noise pollution, habitat degradation). In 1995, CIBRA began to cooperate with the Italian Navy to develop dual uses of ASW technologies and to develop awareness and concern about the potential impact of sonars on marine mammals.

CIBRA participates, since 1999, in the Marine Mammals Risk Mitigation Programme (MMRMP, formerly SOLMAR) project managed by the NATO Undersea Research Centre (NURC) to prevent and reduce the impact of sonars on marine mammals through research and with the implementation of mitigation guidelines and policies; within this programme, CIBRA carried out the 'Bioacoustic Characterization of the Mediterranean Sea' (1999-2003) granted by ONR-USA and began

to work with ACCOBAMS and ASCOBANS to produce guidelines for reducing the impact of anthropogenic noise on marine life. CIBRA cooperates with Columbia University/Lamont-Doherty Earth Observatory to implement mitigation procedures required by the National Marine Fishery Service (NMFS, the USA) during seismic surveys and to develop new detection, data collection and analysis tools and protocols.

The cooperation with the National Institute for Nuclear Physics (INFN) and the National Institute for Geophysics and Volcanology (INGV) led to two important projects: the NEMO-ONDE deep acoustic platform, which had an unexpected discovery of the presence of sperm whales in the western Ionian Sea, and the Listening Into Deep Ocean (LIDO) project funded by EEC.

Research projects today concern mainly marine mammals and their environment, but there are also expanding interests in other zoological groups and all the technologies (information technology, digital signal processing, geographic information systems, global positioning system, etc.) required to improve scientists' ability to collect, process, and interpret bioacoustic data.

Marine mammals strandings

Driven by an expanding interest in environmental monitoring and marine mammal conservation, CIBRA created and runs the National Marine Mammals Strandings Database on behalf of the Ministry of the Environment. The database aim is to collect, validate and publish online stranding data provided by the Italian Stranding Network, which has been operative since 1986. In cooperation

with the Natural History Museum in Milan, CIBRA created the Mediterranean Beaked Whales Strandings Database and runs the National Centre for the Monitoring of Marine Mammals Strandings in connection with the Cetacean Tissue Bank and the Marine Mammals Necroscopy Unit held by the University of Padova; connections are also with the University of Siena, which is mostly concerned with the analysis of environmental contaminants found in stranded animals.

Computational bioacoustics

Researchers at CIBRA were pioneers in developing hardware and software for sound recording and analysis. Research on digital signal processing applied to bioacoustics began in 1980 with the development of the first digital workstation for bioacoustic analyses available in Italy. Since then, new equipment and software have been developed to allow real-time spectrographic monitoring of wildlife, either in terrestrial and marine environments. CIBRA participated to the first European workshop on 'Computational Bioacoustics for assessing biodiversity' and is now engaged in organising the '4th International Workshop on Detection, Classification and Localization of Marine Mammals using Passive Acoustics' along with the '1st Workshop on Density Estimation of Marine Mammals by using Passive Acoustics' (University of Pavia, Italy, 10-13th September 2009).

Bioacoustics for Taxonomy and the European BioAcoustic Network

The collecting of animal sounds is recognised as a valuable tool for taxonomy, systematic and biodiversity research. In the present time of global climate change and biodiversity crisis, it is therefore urgent to facilitate the collection and accurate documentation of acoustic signals in the animal kingdom. Within the EDIT Project (European Distributed Institute of Taxonomy), CIBRA participated in the

creation of the 'European Network of Bioacoustic Collections for Taxonomy, Systematics and Conservation'. The network's aim is to foster cooperation among institutions and researchers to safeguard animal sound recordings and to optimise their use as a resource for research, conservation, and education.

Expertises, consultancy and services

CIBRA, with its scientific personnel and PhD students, has a long worldwide experience in underwater acoustic research into marine mammals and the noise issue; it owns state-of-the-art sound detection equipment (wide-band towed arrays, bottom recorders, hydrophones) designed and built in its laboratories. This equipment is used for CIBRA's own projects and also used as a term of reference for testing and validating other Passive Acoustic Monitoring (PAM) modules and for performing surveys to inter-calibrate different methods and instruments. CIBRA also holds extensive sound libraries, with sounds and noises recorded by different types of detectors in many different environmental conditions. The use of these libraries is essential to test and tune detection and classification algorithms and for this reason certified sound datasets are requested by many laboratories worldwide.

Expertises at CIBRA include acoustic analysis, instrumentation design, software development, organisation of visual and acoustic surveys, implementation of mitigation procedures, design of legislative measures for marine mammal protection, database design, echo-ethological studies in the field.

Other than doing research with prestigious national and international institutions and being committed to education and training, CIBRA provides consultancy and specialised services to other scientific, industrial and military institutions to set up their own experimental protocols, to

design instrumentation and to assist in the design and implementation of mitigation procedures to evaluate and reduce the impact of underwater noise on marine life.

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