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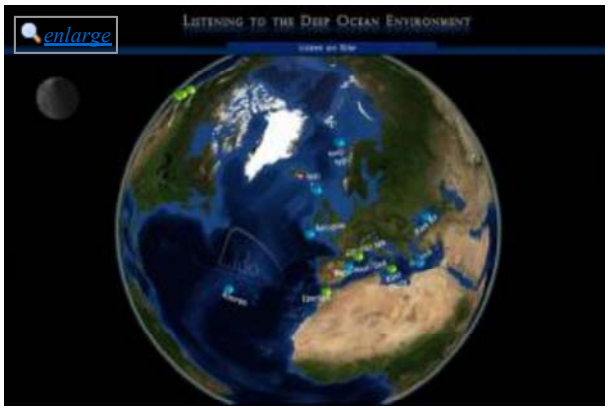
System for Detecting Noise Pollution in the Sea and Its Impact On Cetaceans

ScienceDaily (Dec. 16, 2010) — The Applied Bioacoustics Laboratory (LAB) of the Universitat Politècnica de Catalunya (UPC) has developed the first system equipped with hydrophones able to record sounds on the seafloor in real time over the Internet. The system detects the presence of cetaceans and makes it possible to analyze how noise caused by human activity can affect the natural habitat of these animals and the natural balance of oceans. A new EU directive on the sea has ruled that all member states must comply with a set of indicators for measuring marine noise pollution before 2012.



Listening to the Deep Ocean Environment (LIDO) website. (Credit: Image courtesy of Universitat Politècnica de Catalunya)

In 2007, the Applied Bioacoustics Laboratory started work on a project called Listening to the Deep Ocean Environment (LIDO). It set out to record sounds on the seafloor and subsequently assess the extent to which artificial noises (maritime traffic, fishing, offshore facilities, military maneuvers, etc.) affect the quality of life of cetaceans in terms of any disorders they may suffer, or even their deaths.

Under the supervision of Michel André, the Applied Bioacoustics Laboratory (LAB) has now developed algorithms that automatically interpret these sounds, classify them in real time by their biological or anthropogenic origins and, within this division, the species of cetaceans present in the area analyzed are identified. Using the data obtained, it is possible to measure the extent to which noise pollution has an impact on the conservation of ecosystems.

This is the first system of its kind in the world and saves considerable analysis time and human resources in the detection and classification of noise, as these processes are completely automated. Thus, the technology prevents a continuous flow of unanalyzed acoustic data from overloading hard drives at research centers. Before now, this was one of the problems in processing uninterrupted data streams.

Finally, the acoustic signals and the result of the analysis can be listened to and seen live over a website that is available to the international scientific community and to laypersons

The importance of noise in the sea

There has always been natural and biological noise in the sea. However, the recent, uncontrolled introduction of artificial noise in the sea on an unprecedented scale poses an even greater threat to its equilibrium than any other source of pollution in the marine environment.

The sense of hearing is vital to cetaceans, as they use it to find prey, navigate in the sea, migrate and distinguish members of the same species. Therefore, their survival depends on their sense of hearing working properly.

Using a set of 13 hydrophones installed in over 10 underwater platforms located all over the world, the UPC's system detects the presence of cetaceans and enables scientists to study the relationship these animals have with other mammals in their habitat. This innovative system therefore opens unexplored avenues in the biological study of these species. However, the importance of the LIDO project lies in the possibility of better understanding the sensitivity of cetaceans to sources of noise pollution, detect the interaction of these animals with human activity and, more importantly, it will make it possible to take decisions for mitigating noise when the lives of these mammals are threatened.

To date, the increase in beached whales, sperm whales and other cetaceans around the world has been put down to the greater noise levels caused by fishing, sea trade, military maneuvers, and the construction of oilrigs and offshore wind farms. Thanks the technology developed by the UPC's research team, based on the Vilanova i la Geltrú Campus, it will now be possible to accurately ascertain whether there is a direct cause and effect relationship between the two events.

Based in this information, governments, institutions and businesses that operate in the sea will be able to establish response protocols to prevent these species from falling victim to exposure to noise of an anthropogenic origin that may cause damage to their hearing and, therefore, an imbalance in marine ecosystems.

First step for regulating noise pollution in the sea

The LAB has in fact written a manual of good practices for managing noise pollution in the sea at the request of the Ministry of the Environment and Rural and Marine Affairs, within the framework of the eCREM (Effects and Control of Anthropogenic Noise in Marine Ecosystems) project. The manual is the first step for drawing up a draft bill and good practices to regulate noise pollution in the sea in Spain, which is one of the first countries in the EU that intends to introduce regulations to this regard.

It should be taken into account that forecasts show that maritime traffic in the Mediterranean basin will increase significantly over the next few years to mitigate the atmospheric pollution derived from the transport of goods by road. The new EU directive on the sea rules that all member states must comply with a set of indicators for measuring marine noise pollution before 2012. A group of 11 experts from around Europe, one of whom is Michel André, the director of the LAB, are currently working to establish exactly which indicators are to be used.

The LAB has planned to develop alarm technologies in the near future. They are to be installed on various devices, such as autonomous buoys and underwater robots, which would send off warnings that cetaceans are approaching areas with high noise levels and set off response protocols.

The UPC team has devoted 15 years to the study of noise pollution in the sea and to the creation of technological solutions that make it possible to combine human activities and the interests of industry with the conservation of cetaceans and the marine environment.

The LAB is placing particular emphasis on the study of the effects of noise pollution on cetaceans because these marine mammals are at the top of the food chain, and their activities depend on the exchange of acoustic information. Therefore, their reaction to sources of noise pollution helps to determine the general state of marine environments. Cetaceans are considered to be bioindicators of the acoustic balance in oceans.

International network of underwater observatories

The LIDO platform, which records underwater noise in different parts of Europe and North America, is open to the international scientific community.

Noise sources are detected by hydrophones installed on over 10 underwater observatories. Some of the LIDO sensors have been deployed on the European Seafloor Observatory Network (ESONET), one of whose members is the UPC's Expandable Seafloor Observatory (OBSEA) located on the coast of Vilanova i la Geltrú. The LAB has another set of sensors installed in the deep sea infrastructures of the ANTARES project, an international collaboration that focuses on detecting subatomic particles called neutrinos, which move through space without being stopped by matter. Finally, there are another three hydrophones in North America on the seafloor platforms of the NEPTUNE network in Canada.

The LAB is in the final stages of reaching an agreement with Japan to install the technology on 17 platforms designed to detect the risk of earthquakes in the Asian archipelago.

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