OCEAN NOISE: MAKING SENSE OF SOUNDS

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Understanding the link between natural and anthropogenic processes is essential for predicting the magnitude and impact of future changes of the natural balance of the oceans. The next decades will see increasing levels of offshore industrial development and this will almost certainly lead to increased amounts of noise pollution in the oceans. Amongst these developments, Oil and Gas E&P, offshore constructions, renewable energy production and shipping are to play a leading role in adopting measures to limit their impact on ocean ecosystems. In the meantime, the underwater sound sources associated to those activities present today the highest intensity amongst those anthropogenically generated into the sea. These sounds are known to potentially have physical, physiological and behavioural effects on marine fauna in the area of action: mammals, reptiles, fishes and invertebrates, at various levels depending on the distance to the sound source. Marine mammals could be one of the most sensitive groups of marine species because they have a highly developed auditory system and use sound actively for foraging and for social communication. However, recent laboratory findings indicate that cephalopods could also be sensitive to low frequency noise exposure. If these results were to be confirmed in real-environment conditions, the deleterious effects of marine noise pollution would show to go well beyond those observed in whales and dolphins. Some activities – airgun surveys, pile driving, and sonar uses – have proved to have effects on a wide variety of species. However, these findings on cephalopods introduce an additional question about whether other activities (e.g. shipping, fisheries, offshore operations) that are widely represented in the oceans and produce continuous low-frequency sounds are also disturbing marine fauna. Is noise, like other forms of pollution, capable of affecting the entire web of ocean life? The problem faced by the industry, and more generally by society, is that many economically important activities at sea are indeed at risk because of a lack of information about the effects of anthropogenic sound on marine fauna and especially because of a lack of available tools to model, predict and mitigate these effects. The challenge here is therefore on one hand to implement technological developments that combine the interests of the industry and the good environmental status of the ocean, and on the other hand to develop predictive models to gain additional scientific knowledge to help stronger political resolve. Furthermore, given the global extent of the noise proliferation problem, it must ultimately be addressed on an international scale. Originated in the European Sea-Floor Observatory Network of Excellence (ESONET) in 2007, the Laboratory of Applied Bioacoustics (LAB), from the Technical University of Catalonia (UPC, BarcelonaTech) is currently leading an international project titled "Listen to the Deep Ocean Environment (LIDO, http://listentothedeep.com)" to apply and extent developed techniques for noise measurement and passive acoustic monitoring to cabled deep sea platforms and moored stations. The software framework, called SONS-DCL, is currently active at the ANTARES, France, neutrino observatory, the OBSEA, Spain, shallow water test site, the NEPTUNE Canada, observatory, the JAMSTEC, Japan, network of underwater observatories and at the NEMO, Italy, site after the observatory has been redeployed. Part of the system is being tested for suitability on autonomous gliders and towed arrays in collaboration with the NURC (NATO Undersea Research Centre) and is implemented in several autonomous radio-linked buoys. It is also currently analysing the CTBTO (Preparative Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization) data files from 5 hydroacoustics stations in the Southern Hemisphere. The software contains several independent modules to process real-time data streams. Among these, there are dedicated modules for noise assessment and trends, detection, classification and localization of cetaceans and other acoustic events. This development is allowing the dynamic calibration of classification modules through the continuous flow of data coming from these geographical areas and the long-term building up of a worldwide universal database to identify classes amongst different noise scenarios. A complex issue such as undersea noise pollution cannot be resolved quickly. Yet now is the time when important progress might be possible, with the use of the latest technological development, before the problem of increasing noise pollution becomes intractable and its impacts irreversible.