Oceanography & Fisheries
Open Access Journal

Juniper Publishers
key to the Researchers

Editorial
Volume 1 Issue 2 - June 2016

Fish & Ocean Opj

Anthropogenic Noise in the Marine Environment: Pressures, Trends and Efforts to Prevent the Irreversible

Aristides M. Prospathopoulos*

Hellenic Centre for Marine Research, Institute of Oceanography, Greece.

Submission: May 24 , 2016; **Published:** June 20, 2016

***Corresponding author:** Aristides M. Prospathopoulos, Hellenic Centre for Marine Research, Institute of Oceanography, 46,7 km Athens-Sounio Ave., P.O. Box 712, 19013 Anavyssos, Attiki, Greece, Tel: 30 22910 76410, Fax.: +30 22910 76347; Email: aprosp@hcmr.gr

Editorial

Human activities introduce noise, i.e. unwanted sound, into the marine environment either intentionally for a specific purpose (e.g., seismic surveys) or unintentionally as a by-product of their activities (e.g., shipping or construction). Anthropogenic noise can be broadly split into two main types: impulsive and continuous. The first type includes sounds from offshore construction (construction of cables and pipelines, construction of offshore wind farms, bridges and oil platforms, explosives, pile driving), sonars (naval-military sonars, echosounders - fisheries sonars), seismic survey (airgun arrays operation for oil and gas exploration) and acoustic deterrent and harassment devices. The second type includes sounds from offshore industrial activities (operation of offshore wind farms and oil platforms / dredging, drilling, wind turbines), shipping (commercial shipping, fishing boats and vessels, recreational boating and sports & charter operators, military & coast guards) and marine renewable energy devices (tidal & wave energy). The Convention on Biological Diversity [1] points out the increase of anthropogenic noise in the marine environment over the last 100 or so years due to the growing and diverse aforementioned activities (increase of commercial shipping, expansion of industrial activities including oil and gas exploration and production, commercial fishing, development of marine renewable energy and the growing number of small vessels in coastal areas).

In the next twenty years the marine world is expected to experience major changes due to the economic rise of emerging countries, new consumer classes and demand for resources. The demand for oil and gas is continuously rising, especially from emerging economies, leading to increased oil and gas exploration and production activities. The retreat of the Arctic ice opens up new opportunities for oil and gas exploration, as well as new shipping routes. Even in semi-closed basins as Eastern Mediterranean, which hosts very sensitive marine ecosystems, the exploration for and exploitation of hydrocarbon deposits is a crucial issue for several of the surrounding countries. It is estimated that the worldwide oil production occurred offshore will reach about the 50% of the total oil production by 2030. Also, the international seaborne trade will increase considerably as well as the total tonnage and vessel numbers for all major ship types over the next two decades. As regards the energy sector, 100 times more offshore wind turbines are expected in 2030. Predictions for the increase of the noise level due to the increase of anthropogenic pressures in the marine environment are tractable for ambient noise levels, while increase of impulsive sound levels should be examined at a local/regional scale. A growing body of literature suggests that low-frequency, ambient noise levels in the open ocean increased approximately 3.3 dB per decade during the period 1950–2007. Frisk [2] provided experimental evidence supporting the theory that this increase can be attributed primarily to commercial shipping activity, which in turn, can be linked to global economic growth. Based on an economic forecast made in 2005, he predicted a rate of increase of 2.2 dB per decade or even lower for ambient noise level by 2030. However, the Global Marine Trends 2030 Project Team [3] reported that the world GDP is expected to be increased from 2 to 3 times by 2030, which in turn results in a rate of increase from 3 dB to 4.5 dB per decade.

In any case, human activities have become a major source of noise, particularly low-frequency, throughout many parts of the world's oceans and are exposing about 125 species of marine mammals, and a considerable number - difficult to be defined - of the over 32,000 extant species of fish and tens of thousands of species of marine invertebrates to many more very high-level and chronic (usually lower-level) sounds. However, a large number of marine animals perceive the underwater environment heavily relying on acoustics, since they live in an environment through which sound propagates extremely well and light does not. More particularly, sound plays a key role in their communication, navigation, orientation, feeding and the detection of predators. Many substantive scientific reviews in recent years provide evidence that increasing introduction of noise in the marine environment can have adverse impacts on marine animals: reduce

communication ranges and obscure sounds of interest (known as masking), disrupt reproductive behaviours, affect energetic budgets through interference with foraging and increased travel, exclude animals long term from certain important habitats, induce chronic stress responses, cause temporary or permanent loss of hearing sensitivity, induce physical injury and, in extreme cases, cause animals to die [4]. A wide range of effects of increased levels of sound on marine fauna have been documented both in laboratory and field conditions, while negative impacts for least 55 marine species (cetaceans, teleost fish, marine turtles and invertebrates) have been reported in scientific studies to date. It is estimated that annually the injured animals number more than a quarter million, most notable cases being those of military's use of active sonar and industrial seismic surveys coincident with cetacean mass stranding events. Furthermore, one could not ignore the ultimate effects of underwater noise on the stability of marine food web (affecting the food security of some marine animals) as well as on people and society in terms of lack of ecosystem goods, such as fish stocks, which are already depleted due to overfishing.

The issue of underwater noise and its effects on marine biodiversity has received increasing attention at the international level with recognition by a number of international and regional agencies, commissions and organisations. During the last years, actions and initiatives of international importance and benefit have set up in order to address the challenging questions posed by the effects of increasing ocean noise, such as: the International Quiet Ocean Experiment [5], the science plan of which was published in 2015; the Ocean Noise Reference Station Network of National Oceanic and Atmospheric Administration [6], a set of 10 undersea listening stations deployed around the United States; the projects of the Laboratory of Applied Bioacoustics, Technical University of Catalonia, "Listen to the Deep Ocean Environment (LIDO)" [7] and "20,000 Sounds under the Sea" [8]; the non-mandatory guidelines [9], published by the Marine Environment Protection Committee of International Maritime Organization, intended to provide general advice about reduction of underwater noise from commercial shipping to designers, shipbuilders and ship operators to address adverse impacts on marine life; the Marine Strategy Framework Directive (MSFD), a policy-level initiative which aims to achieve Good Environmental Status (GES) of the European marine environment by 2020: "Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment" is one of the eleven descriptors characterizing GES for which the European Commission published recently an updated report [10], elaborated by the MSFD Technical Subgroup on Underwater Noise, providing monitoring guidance for the Member States.

Anthropogenic underwater noise, officially listed as source of pollution, is acknowledged as a very complex global issue that needs addressing and cannot be resolved quickly. However, it is the time forces to be joined before the problem of increasing noise pollution becomes intractable and its impacts irreversible. Beyond the necessary strong political resolve, of high priority is to scale up the level of management efforts, to promote greater awareness of the issue, to undertake immediate mitigation actions and design long-term solutions based on scientific research results at regional, national and international level in order to overcome a number of significant limitations including the considerable variation in standards and procedures between regions or navies.

In general, scientific research required to understand better, the impacts of anthropogenic sound on marine biodiversity and ultimately on the society is still at primary stage. Open issues of great importance for the research community at regional and international level are: progress on topics such as acoustic sensitivity and population ecology of marine species; studying long-term and cumulative effects of underwater noise for individuals and populations which are still mainly unknown; monitoring long-term changes and trends in the underwater ambient sound field due to anthropogenic and natural sound sources; definition and upgrade of potentially harmful levels of underwater sound; appropriate propagation modelling for important low frequency impulsive and ambient noise sources such as piling and shipping noise, respectively; advancements in underwater acoustic technology; methods and measures for reducing noise from large ships and associated negative effects on ocean life; refinement of existing methods for prediction of ambient noise level in the marine environment, incorporating new ambient noise measurements and global economic data, noise mitigation measures (e.g. quieter propulsion systems of newer ships, and observations of long-term variability in natural/biological noise).

It is not the first time that economic growth and needs of the future world and their impacts, expressed in our case through the increase of the anthropogenic noise in the marine environment, lie at the opposite side of the scale. Research results to the aforementioned open issues are expected to be of crucial weight in the related decision-making processes.

References

1. Convention on Biological Diversity (2012) Scientific Synthesis on the impacts of underwater noise on marine and coastal biodiversity and habitat, UNEP/CBD/SBSTTA/16/INF/12.
2. Frisk GV (2012) Noiseonomics: The relationship between ambient noise levels in the sea and global economic trends. Sci. Rep. 2: 437.
3. The GMT 2030 Team (2013), Global Marine Trends 2030, Lloyd's Register, QinetiQ and University of Strathclyde.
4. Simmonds MP, Dolman SJ, Jasny M, Parsons ECM, Weilgart L, et al. (2014) Marine noise pollution – Increasing recognition but need for more practical action. JOT 9 (1): 70-90.
5. Boyd IL, Frisk G, Urban E, Tyack P, Ausubel J, et al. (2011) An International Quiet Ocean Experiment. Oceanography 24 (2): 174–181.
6. www.pmel.noaa.gov/acoustics/ocean-noise-reference.html.
7. http://www.listentothedeep.com/

How to cite this article: Aristides M. Prospathopoulos. Anthropogenic Noise in the Marine Environment: Pressures, Trends and Efforts to Prevent the Irreversible. Fish & Ocean Opj. 2016; 1(2): 555556.

8. www.upc.edu/saladepremsa/al-dia/mes-noticies/the-applied-bioacoustics-laboratory-lab-will-map-ocean-noise-on-a-round-the-world-sailing-trip?set_language=en

9. International Maritime Organization (2014) MEPC.1/Circ.833.

10. Dekeling RPA, Tasker ML, Van der Graaf AJ, Ainslie MA, Andersson MH, et al. (2014) Monitoring Guidance for Underwater Noise in European Seas, Part I: Executive Summary, JRC Scientific and Policy Report EUR 26557 EN, Publications Office of the European Union, Luxembourg.

How to cite this article: Aristides M. Prospathopoulos. Anthropogenic Noise in the Marine Environment: Pressures, Trends and Efforts to Prevent the Irreversible. Fish & Ocean Opj. 2016; 1(2): 555556.