UNIWERSYTET GDAŃSKI

FUNDACJA ROZWOJU UNIWERSYTETU GDAŃSKIEGO

www.ocean.ug.edu.pl

SEA
FILLED WITH NOISE

How would you like it if your neighbours screamed and shouted by your windows day in day out, or if they disturbed you at night, making loud noises? After one or two sleepless nights, if they did not react to your requests to "please be a little more quiet," you would probably go out of your mind or call the police for help. We are not the only ones who have to suffer noisy neighbours. It turns out that we as people are a very bothersome co-user of maritime space. More specifically, our "wonderful" machines and decisions to operate them in the sea are a nuisance to marine animals.

From time immemorial, seas and oceans, seemingly peaceful and quiet, have been filled with all sorts of the sounds of nature. They are generated by: the wind, waves, ice, rain or even sand grains moving along the bottom of the sea. Crustaceans, fish and marine mammals also produce various sounds. However, these sounds are not noise, but natural acoustic phenomena of the underwater world.

New type of pollution

There are also sounds that are foreign to the water ecosystem and potentially harmful and dangerous to marine organisms. The sources of underwater noise are manmade machines, such as ship, motorboat or water scooter engines, loud acoustic devices used for the exploration of mineral deposits as well as ammunition explosions, impulses sent by echo sounders and sonars, drilling platforms, dredgers and many others. All of them produce noise of different ranges, frequencies and intensities, and their effect on the natural environment classifies them as a source of manmade noise pollution, harmful for many components of the natural world.

This problem is discussed by a number of serious international documents, such as the Marine Strategy Framework Directive, the ASCOBANS Agreement on the Conservation of Small Cetaceans in the Baltic Sea, North East Atlantic, Irish and North Seas and the HELCOM Baltic Sea Action Plan.

Testing the hearing thresholds of the grey seal

SEA FILLED WITH NOISE

UNIWERSYTET GDAŃSKI

More dangerous when in water

In water, sound travels more than four times faster than in the air. This is because particles are closer together in liquids than in atmospheric gases and their higher density propagates acoustic waves. As a result, underwater sounds may be heard from long distances. A high-intensity acoustic wave resulting, for example, from underwater detonations, may damage the hearing apparatus of marine organisms within a radius of several kilometres.

The Baltic is becoming turbid with all the human sewage deposited from fields and houses. Sun rays, which used to penetrate deep into the sea, now reach only a few metres down the water. At the same time, waves transport bottom sediments, suspended matter and clouds of plankton, which significantly reduces visibility. Many marine animals do not live only in illuminated zones. Over hundreds of thousands of years of evolution, some species developed an exceptional sense of hearing. Mammals, such as dolphins or porpoises, developed animal echolocation systems that enable them to emit, receive and interpret sounds. Such bio sonars became a model for the man to construct echo sounders.

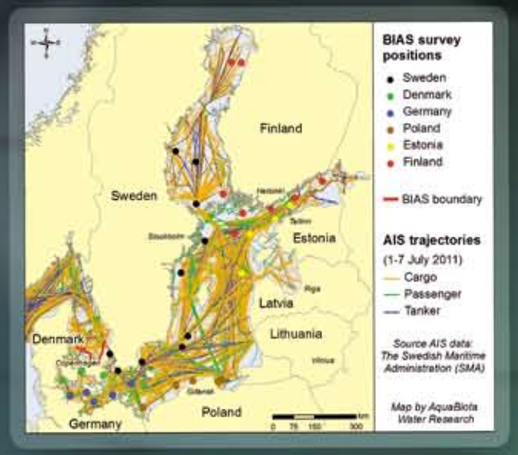
Noise often obstructs our speech, and it also obstructs the sounds made by animals. The inability to receive acoustic signals may cause, for example, dispersion of a group or loss of contact between a young animal and its mother, but it may also be more tragic, like when an animal, surrounded by too much underwater noise, is unable to locate and avoid a dangerous and hard to recognise obstacle, such as a gill net.

Do we have to cause harm with our noise?

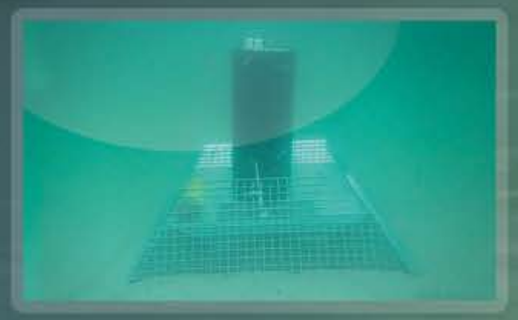
Sometimes, manmade noise is a deadly threat to marine animals. It makes them leave their habitats, have problems with navigation or even lose hearing, which inevitably exposes them to death, if, for example, they come too near to an underwater explosion. One of the major challenges in marine environmental protection is to identify the sources, nature, location and time of manmade noises. A new kind of sea maps are developed: maps of underwater noise.

Soon, the time will come to evaluate the potentially negative impact of acoustic disturbances on marine organisms. Noise affects not only whales, dolphins or porpoises but also seals, fish, prawns or molluscs. So far, there has not been much research in this field, but we know by now that excess underwater noise makes fish grow slower and gain less weight. Also, new and unknown sounds disturb seals relaxing on beaches and it was observed that the noise of New Year's Eve fireworks frightens animals at the seal aquarium in Hel, Poland. These and other reactions of marine animals are examined by the research team at the Marine Station of the Oceanography Institute of Gdańsk University in Hel.

Map of selected ship routes in the Baltic Sea and location of acoustic recorders under the BIAS project



Acoustic recorder at the sea bottom



The Baltic noise map is underway - the BIAS project

Underwater noise is the object of the recent research project BIAS (Baltic Sea Information on Acoustic Soundscape). The project is financed by the European Union (financial component under LIFE+) and the National Fund for Environmental Protection and Water Management. In Poland, the project is implemented by the Oceanography Institute of Gdańsk University and the Foundation for the Development of Gdańsk University. Six countries are involved in the BIAS project: Sweden, Finland, Estonia, Poland, Germany and Denmark. They all deployed - in areas of particularly intense ship traffic - 38 sound buoys, including 5 Polish devices, which recorded the level of underwater noise throughout the year 2014. The buoys record noises whose frequencies are typical of signals generated by watercraft. Each buoy contains a hydrophone (underwater microphone) that registers underwater sounds, which are then converted into binary codes and recorded on memory cards. 80% of the buoys are large capacity batteries: the buoys consume large amounts of electricity in order to continuously record underwater noise for a number of months. Since the buoys could be damaged by trawl nets, special anchoring systems were constructed at the Marine Station of Gdańsk University, which fix the buoys to the bottom and protect them from damage. Buoys may be traced thanks to acoustic release transponders - devices that react to signals emitted from the surface of the sea and release floaters attached to anchors; when floaters float to the surface, it is possible to locate the buoy.

The recorded sounds are analysed in order to determine the level and type of underwater noises in relation to the intensity of ship traffic, based on information from the AIS (Automatic Identification System) and FMS (Fisheries Monitoring Centre).

The end product of the BIAS project is a model of expected underwater noise. The model, based on noises recorded in the Baltic in 2014 and knowledge of the intensity of ship traffic, will make it possible to determine future levels of underwater noise only from the number, route and speed of vessels in the Baltic Sea. Maritime authorities will receive an effective tool to monitor the intensity of underwater noise caused by sea vessels without undertaking costly and difficult hydroacoustic measurements.

BIAS Baltic Sea Information on the Acoustic Soundscape · Life · NFOŚiGW

Underwater sound absorber

Because it is impossible to eliminate most of the sources of harmful underwater noise, the man, as a co-user of the sea, should use modern technology in order to gradually reduce the level of noise caused by the exploration of the marine environment. We take care of our own health and design quiet cars, air conditioners, vacuum cleaners or aircraft engines. Why don't we also develop quiet ship engines, less noisy hydrotechnical construction methods or air curtains to silence underwater explosions? A good start would be, for example, learning to switch off echo sounders in places where we do not need them.

Testing the hearing of the porpoise at the Fjord&Baelt research centre

Will it get any better?

Analysis of the distribution, intensity and frequency of underwater noise and knowledge of the biological needs and tolerances of marine organisms to this type of pollution will help commercial enterprises and authorities responsible for the marine environment set new trends in marine technologies. It will also enable choosing the best - in terms of environmental protection - locations for marine investments.