

The different soundscapes in the Belgian Part of the North Sea

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The Belgian Part of the North Sea (BPNS) is one of the busiest and more exploited marine areas in the world. To be able to assess the impact of human activities in the environment, it is necessary to have long-term monitoring systems. Soundscape studies show a great potential to capture these marine ecological patterns in a non-invasive and continuous way. However, in marine shallow areas where the low visibility entails a major constrain to visual species identification, as it is the case in the BPNS, the sound signatures of most of the species are unknown so a traditional approach of labelling all the known sounds would be very labor-intensive.

To overcome this difficulty, a novel workflow to categorize underwater soundscapes in an unsupervised way was applied to a drifting acoustic dataset from the BPNS. After, these categories were linked to environmental parameters using explainable Artificial Intelligence. With this approach, different soundscape categories were obtained and the main environmental parameters shaping them were assessed, which was used to give an ecological meaning to each category. We obtained 17 different acoustic clusters. The environmental parameters which had the most pronounced influence in differentiating the categories acoustically were the moment of the day, the depth of the recording instrument and the distance to the coast. Furthermore, the benthic habitat and the distance to a shipwreck also had an impact on the acoustic classification.

With this novel method, we could understand the spatio-temporal acoustic variations of a dataset without the need for annotated data and with a fully-automated process. The obtained classes then pointed out the great variability of the marine soundscapes in the BPNS, both in time and space. This reflects the dynamic environment in the BPNS and illustrates the need to study in detail these soundscapes in order to understand the marine acoustic environment.

Keywords

Eco-Acoustics; Underwater Acoustics; Soundscape