

Sharing habitats: Killer whales and anthropogenic noise

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Anthropogenic noise is currently rising in the marine environment, due to the increasing number of human activities, and it is expected to continue to increase in the future. Several studies have shown a significant decrease in habitat biodiversity when exposed to persistent anthropogenic noise. Acoustic communication is vital to cetacean individuals, groups and ultimately population viability. Acoustic signals are used by cetaceans not only for social purposes, but also, in the odontocetes, for feeding, using echolocation clicks. Several studies have demonstrated how anthropogenic noise can overlap with cetacean calls, causing the phenomenon known as acoustic masking. Moreover, cetaceans have been described to display behavioral changes when exposed to anthropogenic noise, such as changes in frequency and/or call rate, also called Lombard effect, or spatial displacement.

Killer whale's acoustic behaviour has been mainly studied using captive animals. Thus, there is a lack of information about the behavioral response of this species when exposed to anthropogenic noise in its natural environment.

In this study, I have investigated the contribution of marine traffic in causing noise pollution and the possible acoustic response of killer whales. Acoustic data were collected via the Lofoten-Vesterålen (LoVe) Ocean Observatory, in Norway, and coupled with marine traffic AIS data from the Norwegian Coastal Administration. The acoustic data analyzed has been selected to present the co-occurrence of killer whale calls and vessel noise, for a total of 13 events. The sound pressure level (SPL) of the recordings from the LoVe Observatory was computed over the whole frequency spectrum, showing high values (above 100 dB) in low frequencies (< 200 Hz) in most of the recordings analyzed, highlighting the role of vessel traffic on the background noise in the area. Moreover, the results from hierarchical modelling confirmed the relationship between the high values in low-frequency SPL and the presence of vessels in the area. Killer whale detections were grouped as either "clicks" or "whistles", to further analyze the effect of anthropogenic noise on both echolocation clicks, used for feeding, and social calls. The distribution of the total number of calls, per group, over all the events recorded didn't have a specific pattern suggesting a heavy effect from the noise level. However, further modelling showed a significant effect of fishing vessels on clicks detected, supporting the previously reported interaction between killer whales and fisheries. Furthermore, the SPL, when coupled with vessel presence, had a significant effect on both call groups, proposing the existence of the "Lombard effect" on killer whales exposed to high levels of anthropogenic noise.

The results obtained describe a situation where human activities must be improved: modifications to the main shipping routes, or stricter requirements for vessels, will help reduce the marine traffic noise, with the ultimate effect of decreasing the negative pressure on the killer whale populations.