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# Measuring changing levels of recreational boating through underwater soundscape monitoring in Loch Lomond, Scotland

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## Abstract

Concerns for the influence of anthropogenic noise on animals in aquatic environments have been increasing in recent years, particularly with regard to the marine environment, but little attention has focused on a similar question in freshwater environments. Loch Lomond is a site of considerable ecological, geological and cultural importance that is located close to highly urban areas and attracts considerable numbers of recreational boaters throughout the summer months, which causes both temporal and spatial variability in the extent of acoustic pollution within the loch. As a result, it is an ideal location to study the effects of recreational tourism on noise in freshwater systems. This study presents preliminary work done as part of an undergraduate summer research experience to measure and compare the underwater soundscape of Loch Lomond, Scotland, with the aim of establishing the level of and variation in acoustic pollution and identifying sources of biological sound that could be affected by it within the loch. In this work, we collected underwater acoustic recordings from a small boat at five sites distributed in different habitats of the loch over a period of three months. These recordings were complimented by shore-based underwater recordings collected from a fixed shallow-water location at the southern end of the loch. From this work, we catalogued a variety of biological sounds, including several likely from known fish species, documented a shift in the dominance of man-made noise through the tourist season, and demonstrated the advantages of involving young scientists in fieldwork, particularly in emergent research areas such as soundscape ecology.

**Keywords:** freshwater habitat, noise pollution, underwater, anthropogenic noise

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