Journal of
Marine Science and Engineering

MDPI

Editorial

Passive Acoustics to Study Marine and Freshwater Ecosystems

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Citation: Buscaino, G. Passive Acoustics to Study Marine and Freshwater Ecosystems. *J. Mar. Sci. Eng.* **2022**, *10*, 994. https://doi.org/10.3390/jmse10070994

Received: 12 July 2022
Accepted: 19 July 2022
Published: 21 July 2022

Passive acoustic monitoring is becoming an important tool to study the ecosystem thanks to technological improvements, high temporal resolution, relatively low cost and time effort, and the zero impact on environment and animal behavior.

Analysis of long acoustic data series is a challenge, and each ecosystem has its own soundscape signature changing with time, for example following the day–night cycle or the alternation of seasons, and in multidimensional space (vertically, horizontally). Some dominant physical and biological components of the soundscape are known, but we need to better understand the acoustic ecosystem, collecting more data and improving automatic analysis, while also applying data analysis techniques already used in other fields to bioacoustics.

In this framework, the Special Issue "Passive Acoustics to Study Marine and Freshwater Ecosystems" includes seven contributions [1–7] published between 2021 and 2022.

Picciulin et al. [1] characterized the coastal soundscape of the Cres-Lošinj Natura 2000 Site of Community Importance (Adriatic Sea, Mediterranean Sea), including the non-tourist and the tourist season. Data were analyzed manually, and two main fish sound types were detected, along with dolphins' vocalizations and human noise pollution such as boat noise, which was higher during the tourist season. The authors suggested management actions to reduce the impact of human noise on this ecosystem.

Vagle et al. [2] used recordings of noise sources on the west coast of Vancouver Island, an area inhabited by cetacean species, combined with the transmission lost modeling to investigate the changes over the time and the space of the noise as a result of natural water column variability. Significant variability in noise levels was observed mainly due to changing water masses. Moreover, vessel noise recorded in the bottom station might not accurately represent that received by whales in near-surface waters. The results of this study highlight that mitigation measures should consider the time and 3D spatial variability of the sound field experienced by a target specie for conservation.

Pintore et al. [3] proposed passive acoustic monitoring methods to overcome the knowledge gaps about the patterns of movement of fin whales in the Mediterranean Sea. They investigated the temporal and spatial variation of fin whale acoustic presence using recordings from five recorders deployed in the Ligurian Sea. Fin whales were recorded almost every day, with the daily vocalization rate being higher during the light hours and closer to the coast. The outcome of this study suggests that not all of the individuals migrate, staying in the Ligurian Sea during the autumn.

Li et al. [4] used passive acoustic monitoring to study deep-diving marine mammals, namely sperm whales, in the northern Gulf of Mexico and to evaluate the impact of the Deepwater Horizon platform oil spill in 2010. Broadband acoustic recordings came from bottom-anchored moorings in the Mississippi Valley/Canyon (recordings period 2007–2017). Short-term and long-term variations in abundances of sperm whales before and after the oil spill were assessed. A habitat preference shift was observed for sperm whales after the 2010 oil spill, with higher activities at sites further away from the spill site. Moreover, a comparison of the 2007 and 2015 results shows that the overall regional abundance of sperm whales did not recover to pre-spill levels. The results indicate the great potentialities of the long-term spatially distributed acoustic monitoring to characterize sperm whale population changes and to assess how stressors (human or natural) impact regional abundances and the habitat use of sperm whales.

Raick et al. [5] empirically measured the maximal propagation distance of different biological components of the coral reef soundscape in Moorea island (French Polynesia). Authors used the audiograms of the fish and invertebrates to estimate that these animals can hear the reef at distances up to 0.5 km. This study contributes to the understanding of the ability of marine species to use acoustic cues to locate reefs, which are a crucial environment to feed and grow up.

Diviacco et al. [6] explored the potential of using off-the-shelf and low-cost technologies combined with a scalable infrastructure developed with open-source tools to monitor soundscape in marine coastal water. Their solution was deployed at sea and provided data continuously to monitor abiotic and anthropogenic temporal trends.

Gregorietti et al. [7] studied the temporal trends of dolphin's acoustic presence in a shallow-water area in the Sicily Strait (Mediterranean Sea) using a passive acoustic monitoring station. Data (14 months of monitoring, about 70,000 h of recordings) were analyzed using both automatic and visual methods, aiming to reveal dolphin whistles. The highest values of both the hourly presence and acoustic activity rate were reached during the night, and the autumn and winter months, suggesting an increase in dolphin occurrence and a possible moving away and towards the monitoring station, potentially following prey. Based on the results of this study, the authors encourage the integrated use of passive acoustic methods with complementary visual surveys. This integration could provide relevant information on the habits of the dolphin community, especially in coastal areas where the interactions with human activities increase the conservation risks for dolphin species.

Funding: This research received no external funding.

Conflicts of Interest: The author declares no conflict of interest.

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