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Editorial: Effects of noise on organisms: from mechanisms to ecological consequences

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Editorial on the Research Topic
Effects of noise on organisms: from mechanisms to ecological consequences

While the second half of the 18th century brought great industrial and technological development to much of the western world, it also generated an unprecedented rise in anthropogenic noise. Although initially overshadowed by more noticeable hazards such as air quality, negative effects of anthropogenic noise on human health have been in the spotlight of considerable scientific research in recent decades (reviewed in Stansfeld et al., 2000; Alves et al., 2020; Yang et al., 2023). Indeed, pervasive urban noise is now considered one of the worst damaging environmental factors for human health (World Health Organization, 2011). It has been linked with a higher risk of cardiovascular problems (Basner et al., 2014; Vienneau et al., 2022), cancer (Andersen et al., 2018; Sørensen et al., 2021), obesity (Pyko et al., 2015; Cai et al., 2020) and diabetes (Sakhvidi et al., 2018; Wang et al., 2020). However, its effects on non-human species have been comparatively less studied. Noise is a global pollutant with effects extending far beyond its source (Buxton et al., 2017; Jerem and Mathews, 2020). Mounting evidence demonstrates its damaging effects on both aquatic and terrestrial taxonomic groups (Shannon et al., 2016; Kunc and Schmidt, 2019), potentially at several levels of biological organization, including the individual, population, community, and ecosystem (Reijnen and Foppen, 1994; Francis et al., 2009; Barber et al., 2011; Proppe et al., 2013; Shannon et al., 2016; Kunc et al., 2016; Phillips et al., 2021).

While it is intuitive to think that humans and other species would benefit by reducing anthropogenic noise, it is important to have an accurate understanding of the mechanisms by which noise pollution impacts the living world, its ecological effects, and extent to which biological systems would be able to return to a basal "health state" if noise is reduced. Progress has been made in this regard (reviewed in Shannon et al., 2016; Kunc et al., 2016; Kunc and Schmidt, 2019; Jerem and Mathews, 2020), but much more research is still needed if we want to truly grasp the deep and diverse ways in which noise can impact organisms at varying levels of organization. This information can bring more awareness to decision makers and aid in future legislation to mitigate its effects. At the same time, it has the added benefit of increasing our understanding of how noise shapes intra- and inter-specific interactions, and ultimately ecological processes, sexual selection, and evolution.

In this Research Topic we collected the newest, and state-of-the-art, research on the effects of noise on organisms. From this new knowledge and updated guidelines can be drawn to mitigate the effects of noise. At the same time, this Research Topic highlights gaps of knowledge that need to be addressed in the future, and new questions and avenues of research.

We have collected seven papers; four address the impact of noise on behavior, at the individual level (Azarm-Karnagh et al.; Chávez-Mendoza et al.; Rhodes et al.; Ritz-Radlinská et al.), two focus on multispecies effects (Kleist et al.; Rosa and Koper), and one contribution is an up-to-date review of the effects of noise at the community level (Kok et al.). While five studies focus on birds (Chávez-Mendoza et al.; Rhodes et al.; Ritz-Radlinská et al.; Kleist et al.; Rosa and Koper), one studies a shrimp (Azarm-Karnagh et al.), and the review by Kok et al. addresses a wide diversity of taxonomic groups. The study by Azarm-Karnagh et al. experimentally shows that red cherry shrimps (*Neocaridina davidi*) can perceive anthropogenic noise and that it can have negative effects on their spatial distribution, latency to find food, and foraging success. With a playback experiment, Chávez-Mendoza et al. studied the vermilion flycatcher (*Pyrocephalus rubinus*) to answer the question of whether noise-induced changes in vocal signals increase the probability of detection. While finding no support for this hypothesis, they give evidence that anthropogenic noise makes individuals more aggressive when defending a territory. Rhodes et al. investigated how a prolific singer and vocal mimic bird, the gray catbird (*Dumetella carolinensis*), adapts its vocal behavior to noise and features of urbanization (degree of impervious and canopy surface). They show that not only noise, but also urban features, predict acoustic attributes of gray catbird songs. The study by Ritz-Radlinská et al. evaluated whether and how, traffic noise, habitat type, and other environmental factors (e.g. temperature, wind speed) are associated to, among other variables, the length of song sequences from yellowhammers (*Emberiza citrinella*). The authors found significant interactions between noise and habitat type and temperature, showing that the effect of noise on bird song can be more complex than previously predicted. This complexity was also highlighted by the six-year study by Rosa and Koper evaluating the effects of noise infrastructure and different types of anthropogenic noise on abundance and nesting success across four songbird species. They showed species-specific effects not only of noise, but also of noise infrastructure. Kleist et al. evaluated different types of anthropogenic noise (aircraft noise, vehicle noise, and noise from people) on the vocal activity of avian communities in several national parks in the United States. They found that after a peak of anthropogenic noise there is a peak in vocal activity; however, this peak in activity was followed by reduced bioacoustic activity for at least 3 hours after noise exposure, showing noise can have a lasting effect on vocal activity at an ecosystem level. Finally, the review by Kok et al. addressed the effects of noise on communities; they included studies published since 1970 on plants, worms, arthropods, fish, amphibians, reptiles, birds, and mammals. The authors explain the wide impact of noise on communities through direct effects (e.g. on the individual) and indirect effects (e.g. via trophic interactions) and highlight some gaps of knowledge and future directions to mitigate the effects of noise.

We hope this Research Topic will aid in our understanding of some of the mechanisms and consequences that underly the effects of noise at several levels of biological organization, at different time spans (short term, long term), and at different spatial scales (local and larger geographical scales).

Author contributions

AR-C: Conceptualization, Writing – review & editing. DL: Writing – review & editing. DP: Writing – review & editing. CT: Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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