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Invited Commentary

The effects of anthropogenic noise on fish: a comment on Radford et al.

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Environmental changes caused by humans are one of the greatest threats to biodiversity, and we are just beginning to understand how these changes affect animals. One form of environmental change concerns the acoustic environment through an increase in anthropogenic noise. According to the World Health Organization (2011), anthropogenic noise has become one of the most harmful types of pollution. Over the last decade an increasing number of studies have shown that noise pollution has an impact on animals on various levels (reviewed in Brumm and Slabbekoorn 2005; Patricelli and Blickley 2006; Slabbekoorn et al. 2010; Kight and Swaddle 2011).

The vast majority of work examining the effect of anthropogenic noise in terrestrial ecosystems has been conducted on birds, and in the aquatic environment on marine mammals. In their review, Radford et al. (2014) pointed out, however, that fish represent more than half of all vertebrate species and provide an important source of protein for many people. Therefore, one of the main messages of their review is that we need a deeper understanding of how fish are affected by noise pollution. This is crucial for conservation and socioethical reasons, but it is also of importance to behavioral ecologists because it allows us to study how animals cope with novel environments.

To understand how fish respond to increasing noise levels a few things have to be considered: Firstly, providing only observational data is not sufficient, because observations do not allow cause-and-effect relationships to be established (cf., Milinski 1997). This sounds straightforward, decades after N. Tinbergen's pioneering experimental work. However, there is still an overwhelming number of observational studies compared with a relatively small number of experimental studies published in the context of noise pollution and its impact on animals.

Secondly, different species of fish might differ in their response to anthropogenic noise based on how they process changes in their acoustic environment. Underwater acoustic stimuli have 2 components: particle motion and sound pressure, both of which can provide information to individuals (Radford et al. 2012). Many species of fish can detect particle motion of acoustic stimuli, and some species can detect sound pressure as well (Popper and Fay 2011). Thus, generalizations of how fish respond to anthropogenic noise might be misleading, and collaborative work of physiologists and behavioral ecologists is needed to understand the complex interactions between how species process sound and their response to noise.

Finally, Radford et al. (2014) raise another important issue, which may be important in fish and animal species more generally: noise might affect species across different sensory modalities. A recently published study, albeit not in fish, showed that anthropogenic noise can affect species using other sensory modalities: cuttlefish relying heavily on visual communication change their visual displays in response to anthropogenic noise (Kunc et al. in press). Since many fish use visual displays, for example, in the context of sexual selection through both mate attraction and male–male competition, anthropogenic noise could have far reaching consequences on more species than previously realized.

Due to the accessibility and the equipment required, studying fish might not be as easy as studying species in terrestrial habitats; however, as Radford et al. (2014) have nicely summarized, we need much more data on the effects of anthropogenic noise on fish to protect them successfully, but also because they are of economic importance.

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