Invited Commentary

Never say never in a noisy world—
commentary on Gagliano’s Green Symphony

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Sound is a fundamental form of energy, ubiquitous on Earth long before the emergence of living organisms and no doubt here long after our tiny planet ceases to support life as we know it. Thus, it is no surprise that many organisms have evolved to make use of sound for a range of ecological processes. In the simplest form, animals are known to detect sound to glean information about their environment, leading to the auditory scene hypothesis for the evolution of hearing (Rogers et al. 1988). Such hearing enables predator avoidance, orientation, and habitat selection. But many animals can also produce sound, from the pure tone chirping of katydids and humming of midshipman fish to the individualized call of the blue whale, the complex song of the nightingale, and the vast range of human vocalizations in both speech and music. The elaboration of noise production by a stunning array of mechanisms seen throughout the animal kingdom, resulting in conspecific and interspecific communication, leads to the alternative matched filter hypothesis for the evolution of hearing, whereby mechanisms of detection coevolve with mechanisms of sound production (Capranica and Moffat 1983).

With such variety in hearing and sound production mechanisms in the animal kingdom and evidence of communication ranging from basic aggressive and antipredator sounds to complex courtship, alarm calling, and storytelling repertoires, it is perhaps surprising that plants have been so overlooked when it comes to acoustic communication. A recently developing field of bioacoustics is that of hearing, sound production, and communication in marine invertebrates, considered until recently to be animals too simple in body plan for complex acoustic interactions, except for the broadband click of snapping shrimp produced from a spectacular implosion of a bubble formed and fired forward from the claw tip. When our work first uncovered the importance of community-generated coral reef noise for orientation and habitat selection by coral reef fish (Simpson et al. 2004, 2005; Radford et al. 2011), the idea of extending this research to invertebrates was seen by many as a step too far. Yet, evidence over the last decade suggests that reef noise induces settling behavior in free-swimming crab and lobster larvae (Stanley et al. 2010), enables holoplanktonic crustaceans to avoid nearby predator-rich reefs (Simpson et al. 2011), and allows coral larvae (a simple cnidarian without a central nervous system or specialized hearing organs) to detect and move toward reef noise when competent to settle (Vermeij et al. 2010). Indeed, it may be the case that anything with hair cells locked into the surrounding medium, be they crustacean antennae, coral planulae cilia, or plant roots growing in a gelatinous matrix, can respond to noise in an ecologically relevant manner.

A recent study has demonstrated that plant roots grow toward noise, perhaps as a mechanism for seeking flowing water in dry environments (Gagliano et al. 2012). So does the evolution of a response of plants to noise fall entirely under the auditory scene hypothesis, or is there scope for a matched filter coevolutionary process? With carefully designed experiments, rigorously upheld definitions of communication, motivated sound production, signaling and response, and an open mind within the bioacoustics community, perhaps there is yet a Green Symphony to play in the coming years.

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