Fear of predators as an ecosystem service

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ABSTRACT

The fear that predators instill in prey induces short-term anti-predator behaviours across every animal taxa that are beneficial in avoiding immediate death, but carry costs; one of the most well-established being that scared prey eat less. These findings, that animals stop eating to avoid being eaten under perceived predation risk, are not controversial. What is controversial is whether such fear effects can be long-term and powerful enough to affect wildlife prey populations and generate trophic cascades. For example, some have suggested that the restoration of wolves to Yellowstone National Park also restored the fear of predators, reducing elk foraging and in turn the pregnancy rate, contributing to rapidly declining elk numbers. Other Yellowstone researchers have suggested that the restoration of fear has generated a trophic cascade whereby scared elk eat less, increasing the food that elk eat. The prospect that fear can help restore populations and ecosystems has critical management implications, but to implement a management plan fear effects must be quantified. Indeed, the enormous amount of often acrimonious debate centred on whether fear can affect populations and ecosystems lingers in both the scientific and public policy domains because studies have largely been based on natural experiments. Manipulations that establish whether fear effects actually do exist for wildlife can help resolve management debates, and are critical for conservation and management on a global scale because the status of large carnivores world-wide is quite dismal with 77 % of species in decline. Public policy would also benefit because if restoring large carnivores also restores fear such that degraded ecosystems can become healthy again, then this has real implications for human lives and livelihoods. We present research from our lab and others, in which perceived predation risk has been experimentally manipulated in free-living wildlife. The results to date definitively demonstrate that fear effects do exist. Fear alters prey foraging behaviour, and fearful prey in turn produce 50 % fewer offspring; fear permanently impairs the reproduction of surviving offspring; and restoring the fear of large carnivores generates cascading effects down at least four tiers in the food chain. Given the enormous effects that fear has in nature, we elaborate on how manipulating fear using sound can be a particularly useful management tool for diagnosing and treating environmental ills. We describe a new system we have designed (Automated Behavioural Response systems-ABRs) that allows any researcher working on any wildlife species to conduct manipulations that quantify fear effects. We conclude that fear has its uses. Fear is good for the environment and as such, management may sometimes need to inject fear artificially for short-term goals (e.g. crop protection) but in many cases, the best and cheapest long-term solution might be to restore native predators where lost.