IEEE IROS 2020 Workshop on
Animal-Robot Interaction

Title
Behavioural and life-history responses of mosquitofish to biologically inspired and interactive robotic predators

Author
Giovanni Polverino

Abstract
Human activities have resulted in the rapid redistribution of the world's biota, assisting some species to colonize regions far beyond their natural range. Consequences of these biological introductions have been severe, with invasive species disrupting ecological communities, driving population declines and species extinctions, and costing billions of dollars every year globally. In freshwater ecosystems the invasive mosquitofish is one of the major threats to biodiversity, and how to eradicate it remains an urgent environmental challenge. Robotics is emerging as a promising tool to study animal behaviour and animal invasions, but whether and how robots can manipulate mosquitofish behaviour and mitigate its ecological success remain unknown. In this study, we tested whether behavioural and life-history responses of invasive mosquitofish can be modulated through a robotic predator whose visual appearance and locomotion were inspired by native mosquitofish predators. We varied the degree of biomimicry of the robot's motion, and observed that real-time interactions at varying swimming speeds triggered stronger antipredator responses in mosquitofish than simpler movement patterns by the robot—swimming on predetermined trajectories and/or at constant speed. Remarkably, we found that non-lethal costs of predation threat extend far beyond behaviour; a 15-min-per-week exposure to a robotic predator elicited stress related physiological changes in mosquitofish associated to loss of energy reserves and compromised body conditions, which are likely to impair reproduction and lifespan. This evidence represents a paradigm shift for uncovering non-lethal consequences of predation threat with the use of state-of-the-art robotic tools, and opens the door for future endeavours to control mosquitofish in the wild.

978-1-7281-6211-9/20/$31.00 ©2020 IEEE