

Examining the Links between Fish Behaviour and Physiology for Resilience in the Anthropocene

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Abstract : Changes in behaviour and physiology are the most important responses of marine life to anthropogenic impacts such as climate change and over-fishing. Behavioural changes (such as a shift in distribution or changes in phenology) can ensure that a species remains in an environment suited for its optimal physiological performance. However, if marine life is unable to shift their distribution, they are reliant on physiological adaptation (either by broadening their metabolic curves to tolerate a range of stressors or by shifting their metabolic curves to maximize their performance at extreme stressors). However, since there are links between fish physiology and behaviour, changes to either of these traits may have reciprocal interactions. This paper reviews the current knowledge of the links between the behaviour and physiology of fishes, discusses these in the context of exploitation and climate change, and makes recommendations for future research needs. The review revealed that our understanding of the links between fish behaviour and physiology is rudimentary. However, both are hypothesized to be linked to stress responses along the hypothalamic pituitary axis. The link between physiological capacity and behaviour is particularly important as both determine the response of an individual to a changing climate and are under selection by fisheries. While it appears that all types of capture fisheries are likely to reduce the adaptive potential of fished populations to climate stressors, angling, which is primarily associated with recreational fishing, may induce fission of natural populations by removing individuals with bold behavioural traits and potentially the physiological traits required to facilitate behavioural change. Future research should focus on assessing how the links between physiological capacity and behaviour influence catchability, the response to climate change drivers, and post-release recovery. The plasticity of phenotypic traits should be examined under a range of stressors of differing intensity in several species and life history stages. Future studies should also assess plasticity (fission or fusion) in the phenotypic structuring of social hierarchy and how this influences habitat selection. Ultimately, to fully understand how physiology is influenced by the selective processes driven by fisheries, long-term monitoring of the physiological and behavioural structure of fished populations, their fitness, and catch rates are required.

Keywords : climate change, metabolic shifts, over-fishing, phenotypic plasticity, stress response

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