World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:15, No:11, 2021

By Removing High-Performance Aerobic Scope Phenotypes, Capture Fisheries May Reduce the Resilience of Fished Populations to Thermal Variability and Compromise Their Persistence into the Anthropocene.

Authors : Lauren A. Bailey, Amber R. Childs, Nicola C. James, Murray I. Duncan, Alexander Winkler, Warren M. Potts

Abstract : For the persistence of fished populations in the Anthropocene, it is critical to predict how fished populations will respond to the coupled threats of exploitation and climate change for adaptive management. The resilience of fished populations will depend on their capacity for physiological plasticity and acclimatization in response to environmental shifts. However, there is evidence for the selection of physiological traits by capture fisheries. Hence, fish populations may have a limited scope for the rapid expansion of their tolerance ranges or physiological adaptation under fishing pressures. To determine the physiological vulnerability of fished populations in the Anthropocene, the metabolic performance was compared between a fished and spatially protected Chrysoblephus laticeps population in response to thermal variability. Individual aerobic scope phenotypes were quantified using intermittent flow respirometry by comparing changes in energy expenditure of each individual at ecologically relevant temperatures, mimicking variability experienced as a result of upwelling and downwelling events. The proportion of high and low-performance individuals were compared between the fished and spatially protected population. The fished population had limited aerobic scope phenotype diversity and fewer high-performance phenotypes, resulting in a significantly lower aerobic scope curve across low (10 °C) and high (24 °C) thermal treatments. The performance of fished populations may be compromised with predicted future increases in cold upwelling events. This requires the conservation of the physiologically fittest individuals in spatially protected areas, which can recruit into nearby fished areas, as a climate resilience tool.

Keywords : climate change, fish physiology, metabolic shifts, over-fishing, respirometry
Conference Title : ICAFM 2021 : International Conference on Aquaculture and Fisheries Management
Conference Location : Tokyo, Japan
Conference Dates : November 11-12, 2021