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Additive and synergistic impacts of fishing and warming on the growth of a temperate marine fish

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Fishing and climate change are having profound impacts on the trajectory and variability of marine populations. However, despite the wealth of work undertaken in marine environments on the causes of longer-term biological change, the effects of these two drivers have traditionally been considered in isolation or just additively. This is despite an increasing acknowledgement that the direction and magnitude of biological responses to environmental variation can be mediated by other anthropogenic disturbances such as fishing, and vice versa. Somatic growth is an ideal candidate with which to explore the interacting impacts of fishing and environmental variability due to its strong biological relevance and its heightened sensitivity to natural and anthropogenic drivers. I developed 19-year growth biochronologies (1980-1999) for three south-east Australian populations of a site-attached temperate reef fish, purple wrasse (*Notolabrus fucicola*) using individual-based growth information archived in otoliths. A commercial wrasse fishery began in 1990. The growth of older fish was proportionally higher after the onset of fishing with 5 and 10-year-olds growing 10. 3% faster respectively, results consistent with a density-dependent response to harvesting. Average growth rates across all ages increased by 6. 6%.$^{o}C^{-1}$. Finally, the distribution of individual thermal reaction norms significantly changed post fishing, showing that fishing and temperature can have a synergetic impact on marine populations via within-individual responses. Understanding the relative importance of, and interaction between, natural and anthropogenic drivers in shaping marine systems provides valuable ecological and evolutionary context that is essential to sound fisheries management and species conservation.

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