Impact of combined climate change stressors on marine fish and fisheries

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Project description

Assessing the response of marine fish communities to climate change continues to pose a real challenge to scientists and managers. This studentship will provide vital data on the responses of marine fish to climate change's "deadly trio" of warming, CO_2-induced acidification, and reduced oxygen (hypoxia). These can each individually have major impacts on marine fishes and are all predicted to occur more frequently and over a much greater geographic extent in the near future. Previous Defra-funded research projects (e.g. 'Marine Ecosystem Connections') have already recorded persistent low oxygen regions in the North Sea. While tolerance of, and biochemical, physiological and behavioural responses to, hypoxia are well studied in individuals of "model species", little research has been done to understand the impact of these combined stressors on fish populations and fisheries. There are global implications of hypoxia for fisheries as fish do grow slower under hypoxia, but smaller scale studies are also needed to truly understand individual stock effects. Similarly, studies are lacking on the effects of seasonal or episodic periods of low oxygen and pH across a range of important species of commercial value (e.g. Atlantic cod, European sea bass) and conservation concern (e.g. European eel and Atlantic salmon). To more accurately predict the likely population effects of these multi-stressors requires integration of experimental results with modelling techniques, particularly within a fisheries context relevant to the UK.

The effects of the "deadly trio" on fisheries can be modelled where sufficient information is available. For this, functional biomarkers (sensitivities and traits) that are suitable to parameterise forecast models of fish populations need to be identified. The impacts of these stressors on such biomarkers also need to be understood for a range of relevant species. This student will generate data to score these biomarkers for use in traits-based analysis and/or in various different population modelling approaches. The outcomes will be used to provide fisheries and environmental managers with a better understanding of how climate change is likely to affect the abundance and distribution of fish stocks. Recent developments in projections of O_2, temperature and CO_2/pH into the coming century, will also help determine likely changes in fish behaviour and

distributions.

Experimental work will be combined with modelling and GIS techniques to map prevalence of the “deadly trio” and vulnerability of fish populations (including their spawning, nursery and feeding grounds) to identify which species may become more vulnerable or may temporally change location.