

Jennifer Freer

University of Bristol, United Kingdom

Predicting the response of Southern Ocean lanternfishes to future climate change

Jennifer J. Freer [1], Geraint A. Tarling [2], Julian C. Partridge [3], Martin C. Collins [4], Martin J. Genner [1]

[1] University of Bristol, Bristol, UK; [2] British Antarctic Survey, Cambridge, UK; [3] University of Western Australia, Perth, Australia; [4] Centre for Environment, Fisheries and Aquaculture Science, Lowestoft, UK

Lanternfishes (Myctophidae) are the most abundant and ecologically important family of mesopelagic fishes in the Southern Ocean, yet how these species will respond to climate change is unclear, especially within polar regions where macro ecological principles govern community composition. Using species distribution models, we investigated environmental factors driving the distribution of ten lanternfish species throughout their polar range. After optimising models for the present day, we projected these distributions under future conditions simulated by eight climate models, in both stabilising (RCP 4.5) and rising (RCP 8.5) emission scenarios, for the time periods 2006-2055 and 2050-2099. We found that temperature, salinity at 200m, and primary productivity were the most important environmental correlates with present day distributions. Under future scenarios, all but one species are consistently predicted to undergo a poleward distribution shift. Though species responses were highly dependent on the climate model used to simulate future conditions, we found a significant positive relationship between the predicted change in suitable area and the proximity of a species to its upper thermal limit. We also found a significant negative correlation between the maximum attained size of species and their minimum latitude of occurrence. Thus, as smaller lanternfish species move further south, our results predict a decline in species richness at Sub-Antarctic latitudes and an increase in species richness south of the Polar Front. These changes may alter the size structure of the lanternfish community and negatively impact the foraging grounds of Southern Ocean predators. We conclude by discussing current limitations to predictive modelling, and suggest ways to improve our predictive capacity for Southern Ocean pelagic species.