Evaluating drivers of spatiotemporal individual condition of a bottom-associated marine fish

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Dear Editor,

I am submitting the manuscript ‘*Evaluating drivers of spatiotemporal individual condition of a bottom-associated marine fish*’ for consideration to be published as a Research article in *Proceedings of the Royal Society B: Biological Sciences*.

The body condition of fish in an important trait is associated with fitness. Fish in poor condition grow slower, have higher natural mortality rates, and produce less offspring. Atlantic cod in the Baltic Sea have seen a major reduction in the average condition in the population since the early 1990s, and this had been linked to detrimental environmental conditions (declines in sea bottom oxygen concentration), competition and a lack of food.

In this study, we, for the first time, evaluate the ability of several standardized biotic and abiotic covariates on spatial scales ranging from fine-scale to basin scale to explain variation in individual-level condition. Furthermore, we also model changes in the spatial distribution of cod to quantify the magnitude of environmental changes that cod have experienced in the last 3 decades. To account for autocorrelation, we use geostatistical models that explicitly model account for latent spatial and spatiotemporal processes.

Our results support previous studies in that oxygen and sprat biomass are positively associated with condition, while depth is negatively associated with condition. However, we are also able to show that cod experience oxygen concentrations higher than previously estimated based on their depth-distribution, and that the effects of covariates are relatively small compared to latent spatial and spatiotemporal variation. Our novel approach to investigate the declining body condition of Atlantic cod from a spatiotemporal perspective also reveals that the condition decline in whole area relatively homogenously. As such, we believe findings have contributed with new perspectives and will spur further research into what factors could explain the decline in condition across large spatial scales.

We are grateful for your consideration of our manuscript, and we look forward to hearing from you.

Sincerely,

Max Lindmark, on behalf of all co-authors

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