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| **Dr Spencer Barrett**  **Editor-in-Chief of *Proceedings B*** | **Dr Max Lindmark**  Sveriges lantbruksuniversitet Swedish University of Agricultural Sciences  Department of Aquatic Resources (SLU Aqua) Institute of Marine Research Turistgatan 5, SE-453 30 Lysekil  Phone: +46104784173  E-mail: [max.lindmark@slu.se](mailto:max.lindmark@slu.se)  Lysekil, 2022-04-22 |

Dear Dr Barrett,

Please find attached the original manuscript entitled ‘*Evaluating drivers of spatiotemporal individual condition of a bottom-associated marine fish*’ by Max Lindmark, Sean C. Anderson, Mayya Gogina and Michele Casini. I confirm that the presented material is new and has not been published or submitted for publication elsewhere.

This manuscript, submitted for consideration as a Research article in *Proceedings of the Royal Society B: Biological Sciences,* investigates the drivers of an important body condition trait associated with fitness of organisms. In poor condition, fish grow slower, have higher natural mortality rates, and produce less offspring. Atlantic cod in the Baltic Sea have undergone a major reduction in the average condition since early 1990s. This has been linked to detrimental environmental conditions (declines in sea bottom oxygen concentration), competition, and lack of food, but detailed understanding of responses has been missing.

Here, for the first time, we evaluate the ability of several standardized biotic and abiotic covariates on spatial scales ranging from fine to basin scale to explain variation in individual-level condition. Furthermore, we model changes in the spatial distribution of cod to quantify the magnitude of environmental changes that cod have experienced in the last 3 decades. We use geostatistical models that explicitly 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. However, in contrast to previous estimates of experienced oxygen concentrations based on fish depth distribution, we show that cod have experienced relatively high oxygen concentrations (above thresholds for negative effects), 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 the whole area is relatively homogenous. Our findings can provide new perspectives for further research to better understand the decline in fish condition across large spatial scales and thereby improve management solutions.

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

Yours sincerely,

Max Lindmark