

Dr Howard I. Browman
Editor-in-Chief of *ICES JOURNAL OF*
MARINE SCIENCE

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Dear Dr Browman,

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.

This manuscript, submitted for consideration as an article in *ICES Journal of Marine Science*, investigates the drivers body condition—a key organism trait affecting fitness via mortality and reproductive output. 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 the relative contributions of these variables across scales is largely unknown.

In this study we evaluate how a set of hypothesis-driven covariates across spatial scales can predict individual-level fish body condition over the last three decades using geostatistical models that explicitly account for latent spatial and spatiotemporal processes and cod in the Baltic Sea as a study species. We find persistent spatial low spots of body condition and that biotic and abiotic covariates have small effects compared to latent spatial and spatiotemporal variation, which explain almost five times more variation. Potentially this is due to the large individual variation in condition, unmeasured covariates or condition being shaped over long time periods.

Moreover, we illustrate the importance of accounting for species' heterogeneous spatial distribution when estimating their environmental conditions. For oxygen we find that our density-weighted estimates differ both in magnitude and trend over time from the un-weighted average oxygen trends in the environment.

We believe our study is suitable for publication in *ICES Journal of Marine Science* as it makes substantial contributions to our understanding of how the body condition of Atlantic cod in the Baltic Sea varies in space and time in relation to physical, oceanographic, and biotic variables. It also shows a general approach to quantify organisms' experienced environmental conditions using species distribution models and weighted environmental variables, with many potential applications, e.g., in climate change research.

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

Yours sincerely,
Max Lindmark