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Dear Editor,

I am submitting the manuscript ‘*Optimum growth temperature declines with body size within fish species*’ for consideration to be published as a research report in *PNAS*.

Understanding how key physiological processes such as growth, feeding and metabolism depend on body size and temperature is key for predicting impacts of global warming on individuals, populations and food webs. In growth models and mechanistic population models we often rely on interspecific estimates to characterize these relationships (1, 2). This is problematic, since growth, feeding and metabolism are individual-level processes, and thus likely are accurately represented by intraspecific relationships. However, intraspecific estimates are surprisingly rare in the literatures, in particular average intraspecific estimates *across* species, which are needed for making general predictions.

In this study we aim to overcome this by first collating intraspecific experimental data on fishes using a standardized literature search (total n=3672 from 59 studies). Next we apply hierarchical Bayesian models to estimate average mass and temperature dependence of these rates within species by accounting for variation across species. Lastly, we investigate the implications of our estimated scaling relationships for growth using a common supply and demand growth model.

Our results show how that on average within species, metabolic rates increase faster with body mass than feeding rates. In addition, feeding rates are unimodally related to temperature. These two conditions lead to a prediction that the optimum growth temperature declines with body mass within species. By collating a data set on growth on fishes using the same protocol, we identify that indeed optimum growth temperatures within species of fish decline, in line with the prediction based on the scaling of feeding and metabolic rates.

Therefore, we believe our manuscript provides insights to several topics interesting to a broad readership, including the recent debates about the commonly observed (but poorly understood) negative impacts of warming on growth in large fish within species and provide a simple mechanism that can reproduce this response. We also clearly identify deviations from general metabolic scaling theories at the within-species level. Overall, our study highlights need to investigate intraspecific relationships as these deviate from interspecific relationships, but also the ability of simple mechanistic models to reproduce the common pattern of large individuals of ectotherms species struggling with growth when it gets too warm.

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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1. D. J. Marshall, C. R. White, Have We Outgrown the Existing Models of Growth? Trends in Ecology & Evolution 34, 102–111 (2019).

2. D. A. Vasseur, K. S. McCann, A mechanistic approach for modelling temperature-dependent consumer-resource dynamics. The American Naturalist 166, 184–198 (2005).