**Proposal for a Contribution to the special issue on “Ecological and Evolutionary Insights from Very Long-Term Studies” to be published by Ecology Letters in 2024**

Proposed contribution type: Letter

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Proposed title: Warming increases body growth in cold but reduces growth in warm populations of a common fish

**Proposal (expected length < 300 words) which should (a) briefly describe the long-term dataset(s) that you are analyzing, including study site location, observations, experimental treatments if relevant, and the years involved, (b) succinctly explain why the proposed manuscript would be novel, important, and of general interest in ecology and (c) explicitly state the importance of very long-term data for this study.**

**a)** We for the first time compiled data sets of length-at-age from annuli rings on operculum bones (215,975 measurements across 41,212 individuals) from 12 monitoring areas along the Baltic Sea coast, from 56.1°— 65.9° Latitude, with the longest time series starting in 1953 (average time series length across all areas is 32 years). To these data, we fit von Bertalanffy growth models to each individual and analyze the median growth coefficient (describing the rate of growth early in life) across individuals by cohort and area and its non-linear relationship with temperature. Temperature data were in turn compiled from 3 sources with complementary strengths: ERRS predictions (long time series, low spatial and temporal resolution), measured temperature at fishing at fishing (relatively long time series, low temporal resolution, close proximity to growth samples), and daily temperatures from deployed loggers (short time series, close proximity to growth samples, high temporal resolution). These data were modelled with Generalized Additive Models to standardize for source and the cyclic day-of-the-year effect to acquire area-specific growth season averaged temperatures. Two of the areas have in turn been artificially warmed by nearby nuclear power plants, which introduces an unusually large temperature gradient, with growth-season averaged temperatures ranging from 7°C—23°C.

**b+c)** We have analyzed spatiotemporal growth data to understand how warming effects on growth in fish (Eurasian perch, *Perca fluviatilis*) depends on temperature. This is highly relevant for the larger and growing topic of predicting the effects of climate change on organismal growth rates and body sizes, for which several general rules and patterns have been proposed. Our study is perfectly suited to fill in key knowledge gaps into the impacts of climate change on growth because the time series are long enough to detect climate signals from cohort effects, it has unusually large temperature and spatial contrasts which aids detection of signals, and data come from a stationary species, meaning we can link locally predicted temperatures to growth data. Improving our understanding of climate impacts on growth is critical for making predictions about future ecosystems.

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