Thermal sensitivity of metabolic rate mirrors different biogeographies between teleosts and elasmobranchs

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Environmental temperature affects physiological functions, representing a barrier for the range expansions of ectothermic species. To understand the link between thermal physiology and biogeography, a key question is whether among-species thermal sensitivity of metabolic rates is mechanistically constrained or buffered through physiological remodeling over evolutionary time. The former conception, the Universal Temperature Dependence (UTD) hypothesis, predicts similar among- and within-species thermal sensitivity. The latter conception, the Metabolic Cold Adaptation (MCA) hypothesis, predicts lower among-species thermal sensitivity than within-species sensitivity. Previous studies that tested these hypotheses for fishes overwhelmingly investigated teleosts with elasmobranchs understudied. In this study, we show that among-species thermal sensitivity of resting metabolic rates is lower than within-species sensitivity in teleosts but not in elasmobranchs. Moreover, species richness declines with latitude more rapidly in elasmobranchs than in teleosts. MCA exhibited by teleosts might underpin their high diversity at high latitudes, whereas the inflexible thermal sensitivity approximated by UTD of elasmobranchs explains their low diversity at high latitudes.