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Thermal physiology of the common eelpout (*Zoarces viviparous*)

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Abstract:

We investigated the temperature dependence of some physiological parameters of common eelpout (*Zoarces viviparous*) from different locations (North Sea, Baltic Sea and Norwegian Sea) on acclimation temperature (3 °C and 12 °C) and acute temperature variation. The lethal limit of 12 °C-acclimated eelpout was determined as the critical thermal maximum [loss of equilibrium (LE) and onset of muscular spasms (OS)] and it was found to be 26.6 °C for LE and 28.8 ° C for OS for all populations. However, these parameters do not have any relevant ecological interpretation. We therefore investigated the effect of gradually increased water temperature on standard metabolic rate (measured as resting oxygen consumption Mo_2) and critical oxygen concentration ($[O_2]_c$) of eelpouts. Acclimation to low temperature (3 °C) resulted in partial compensation of Mo_2, paralleled by a decrease of activation energy for Mo_2 (from 82 kJ mol^{-1} at 12 °C to about 50 kJ mol^{-1} at 3 °C) in North Sea and Baltic Sea eelpouts. At the same time, Norwegian eelpout showed no acclimation of oxygen demand to warm temperature (12°C) at all. The cope for eelpout aerobic metabolism shrank considerably with increased acclimation temperature, as $[O_2]_c$ approached water oxygen concentrations. At 22.5 ± 1 °C the $[O_2]_c$ reached air saturation, which is equivalent to the upper critical temperature (Tc_{II}) and at this temperature the aerobic scope for the metabolism completely disappeared. In line with previous insight, the comparative analysis of the temperature dependence of Mo_2 of Z. *viviparous* from different populations suggests that a pejus (sub-critical) temperature for this species is about 13-15 °C. In conclusion, the capacity to adjust aerobic metabolism relates to thermal tolerance and the bio-geographical distribution of the species. Global warming would thus be likely to cause a shift in the distribution of this species to the North.

Key-words: Critical oxygen concentration, critical temperature, aerobic scope, pejus temperature, geographical distribution