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What can the swimming metabolism of the world's hottest fish tell us about the oxygen- and capacity-limited thermal tolerance (OCLTT) hypothesis?

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The small cichlid *Alcolapia grahami* of Lake Magadi, Kenya lives in perhaps the most extreme aquatic environment on earth (pH~10, alkalinity~300 mequiv $L^{-1,}$ bizarre water chemistry, challenging O_2 and temperature regimes, high ROS). It is the only known 100% ureotelic teleost. We studied two isolated populations, one living in a flowing hot spring (SWHS) with great diurnal temperature fluctuation (32-43˚C), the other living in a static lagoon (FSL) with a fairly stable temperature (33–36˚C). The SWHS fish are more streamlined and have a much larger gill area. The upper lethal temperatures (Ct_{max}) of both populations are similar and very high (> 44˚C); moreover the SWHS tilapia exhibit the greatest Ct_{max} ever recorded. Routine MO_2s were measured on site in the field, and also in the laboratory, and Brett-style swimming respirometry trials were performed at 25, 32, and 39˚C. The SWHS fish exhibited greater critical swimming speeds than the FSL fish at all three temperatures. FSL fish swam poorly at 39˚C. Routine MO_2s increased with temperature in both populations, and were significantly greater throughout in the SWHS fish. However, in FSL fish, $MO_{2min,}$ $MO_{2max,}$ and absolute aerobic scope were independent of temperature, whereas all three increased markedly with temperature in SWHS fish. Clearly, the SWHS fish ("athletes") exhibit a pattern which could be congruent with the OCLTT hypothesis, whereas the FSL fish ("couch potatoes") do not. Differences in phenotypic or genetic adaptation to different environments may greatly influence patterns observed within a species. (NSERC Discovery–Canada; NRF- South Africa; CNPq-Brazil).

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