402

THE WARMER SIDE OF ANTARCTIC FISH: THERMAL ACCLIMATION IN PAGOTHENIA BORCHGREVINKI

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The marine environment of McMurdo Sound is characterised by year-round temperatures that approach the freezing point of seawater. The fish that live in this stable but inhospitable environment possess a suite of adaptations to permit their survival, growth and reproduction. Previous scientific thought held that these adaptations limited the ability of Antarctic fish species to acclimate to warmer temperatures. However, this has proven to be incorrect for at least one species – the active, cryopelagic, *Pagothenia borchgrevinki*. This species thrives at 4°C and demonstrates an acclimation response in resting oxygen consumption and sustained swimming speed during a one month experimental period. The acclimation response was investigated in *P. borchgrevinki* at Scott Base during the 2004/2005 Antarctic Summer Season. Fish acclimated to 4ºC for one month reached a maximum sustainable swimming speed (Ucrit) at 4°C of 2.04 bl/s (body lengths per second) (±SEM 0.11; n=8) which was significantly higher than the Ucrit of non-acclimated fish swum at 4°C (1.56 bl/s ±0.05; n=8; $P<0.01$). Initial exposure to 4ºC resulted in an increase in resting oxygen consumption to 57.75 mg $O_2/kg^{-1}/h^{-1}$ (±SEM 4.79; n=8) in experimental fish, compared to 34.45 mg $O_2/kg^{-1}/h^{-1}$ (±SEM 3.12; n=8; $P<0.01$) in control fish. However, during the time course of acclimation, the resting oxygen consumption of experimental fish fell, so that after 22 days there was no significant difference between values for experimental and control fish. Acclimation responses at the whole-animal level are underpinned by changes at the biochemical level, such as changes in enzyme activity. Changes in the activity of lactate dehydrogenase and cytochrome C oxidase were investigated in *P. borchgrevinki* in New Zealand during 2005. CCO activity in the red muscle was significantly higher in fish acclimated to 4ºC for one month (31.5 units/ml ±SEM 4.55; n=8) than controls (13.5 units/ml ±SEM 1.84; n=7). LDH activity in the white muscle was similar in both groups. These results suggest that although *P. borchgrevinki* is adapted to survive in the thermally stable waters of the Antarctic, it is still capable of metabolic compensation at higher temperatures.