QCL WATER SCIENCE

UNIVERSITY OF GOTHENBURG

PyroScience FireSting

Perch Have What it Takes to Beat the Heat

We have been using PyroScience sensor technology in our labs for the past couple of years to measure aerobic metabolic rates of fishes under various environmental conditions. A recent project in August 2013 brought a group of young scientists together to examine the physiological mechanisms associated with thermal tolerance and acclimation in European perch (Perca fluviatilis). The setting for this field study was in Forsmark, Sweden, where we stayed in camper trailers on the banks of the Baltic Sea. However, this was not a typical field site, we were camping beside a nuclear power plant! For the past 30 years, water from the Baltic has been pumped through the cooling circuits of the three nuclear reactors and the warm effluent water has been directed into a nearby lagoon termed the 'Biotest enclosure'.

Fig. 1: Aerial view of the Biotest enclosure in Forsmark. Heated water from the cooling circuits of the nuclear reactors enters the enclosure via tunnels under the sea bed to the left

Today, this facility presents us with a unique large-scale experimental model to study the effects of chronic warming on wild fish populations, which is particularly relevant as the global climate continues to warm. Many fish species have not been able to cope with the warmer conditions in the Biotest enclosure over the past three decades and have disappeared from the area, yet the perch have prevailed. With a focus on the cardiorespiratory system, our goal on this field trip was to investigate the physiological mechanisms that underlie this exceptional thermal resilience of perch. To address this goal, we used PyroScience sensor technology to measure a range

Fig. 2: A four-channel Firesting-O2 meter beside a respirometer containing a perch

of physiological parameters from live perch, including aerobic metabolic rates and the oxygen partial pressure of venous blood during exposure to high temperatures. Venous oxygen tension is a crucial variable in these animals as it represents the main oxygen supply to the heart and is thought to be an important limiting factor for cardiac performance in fishes at high temperatures. Continuous recordings of oxygen partial pressure in the blood were made possible by collaboration with the technicians at PyroScience who developed a novel configuration of an oxygen optode that could be surgically implanted into a large central vein.

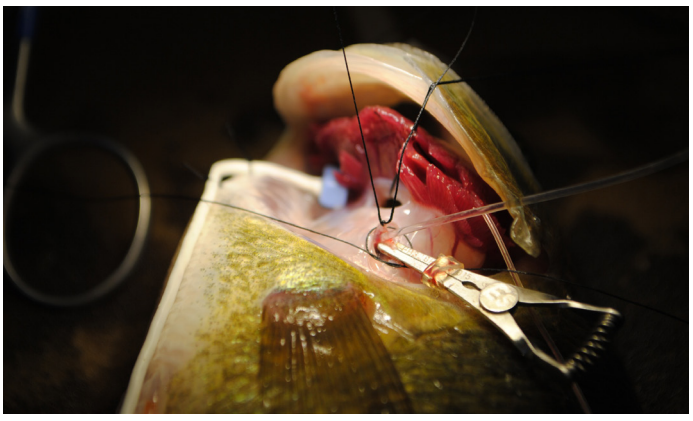

Fig. 3: Detailed view of the opercular cavity of a perch under anaesthesia implanted with a custom made PyroScience optode in the sinus venosus for continuous measurements of partial pressures of oxygen in venous blood

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