

## Final report COST FA1304 FitFish Ph.D. course Methods and practical approaches for measuring oxygen consumption in resting and swimming fish

From May 9<sup>th</sup> to Friday 20<sup>th</sup> a Ph.D. course was held in the aquaculture section of the Technical University of Denmark. A total of 11 students participated (4 last minute cancellations), with geographical representation from USA, Romania, Norway, Turkey, Portugal, Denmark, Croatia, and Spain. The majority of trainees were Ph.D. students, with a few post-doctoral researchers and M.Sc. students. The trainers were Peter Vilhelm Skov (DTU Aqua), John Fleng Steffensen (U of Cph) and Peter Bushnell (Indiana University).

The course was organised as mixture of lectures, demonstrations and project work. Students had been asked in advance about any topics that they particularly wanted to work with in their projects, which was not the case.

The first week was an even mix of lectures and demonstrations/exercises. Lectures covered measurements of oxygen uptake in fishes, different equipment and approaches to measuring oxygen use in fish, data treatment, common pitfalls, laboratory v. field measurements, non-invasive techniques, solubility of dissolved gases in water, calculating oxygen transfer, energy use in fish, substrate used for ATP production, what fish use energy for, measurements of oxygen use on a tank basis, using CO<sub>2</sub> and N excretion to calculate fuel use, and metabolic costs of processing meals. These are compiled as a single pdf.

Demonstrations included using commercial and custom made software for measuring and calculating oxygen use in fish, software and approaches to analysing data examples, building your own DYI equipment, and manufacturing optodes for measurements.

During the end of the first week, trainees gradually spent more time on their projects. Three projects were selected for students to work on in groups of 3-4 persons; oxygen consumption in resting fish, oxygen consumption in swimming fish, and tank based respirometry. Fish species that students worked with were rainbow trout, sea bass and pompano. Project work was centred around producing real data, but also testing for and identifying potential sources of error arising from wrong fish: water volume ratios, leaky equipment, diffusion of oxygen across water surfaces, etc.

On the last night of the course, students presented their results in their respective groups. This gave rise to some nice discussions about pros and cons of different approaches to measuring on single fish or groups of fish, swimming versus resting, fed vs starved, etc. Trainee presentations are compiled as a single pdf.

In general the course was a great success. The trainees expressed great satisfaction about the course, and several expressed interest in STSMs that were also advertised during the course. On behalf of the organisers, we thank the COST Action for the financial support that made it possible to hold this course. It was a great experience for all.

Best regards,

A handwritten signature in blue ink, appearing to read 'Peter Vilhelm Skov'.

Peter Vilhelm Skov  
*Associate Professor*  
Section for Aquaculture