

Shining the Light on Aquaculture

Light is playing a key role in most organisms to entrain biological clocks and synchronise most physiological functions to the time of day or year. As such light can be used as a powerful tool in aquaculture to enhance fish productivity and welfare through, among others, the control of broodstock spawning (spawning on demand), the optimisation of egg and larvae survival, the control of smolt time, the suppression of sexual maturation during the on growing phase or the control of external pigmentation. Light impact on fish is complex, three components must be considered: spectral composition, intensity and photoperiod which vary during the course of a day and year. There is extensive evidence demonstrating the complexity of the light perception system in fish which involves photoreceptive structures (e.g. retina, pineal gland), which convey information to the brain, as well as deep brain photoreceptor cells, the nature of which awaits further characterization. Furthermore, there is a strong indication that the control of the pineal activity has changed dramatically during phylogeny, probably as a response to 500 million years of evolution to the diverse environments occupied by vertebrates during that time. Different specialized structures (e.g. pineal complex, retina, parietal eye, deep brain) and pathways would have thus evolved in

vertebrates, although the main basic components e.g. the non-visual photoreceptors are likely to be conserved.

However, to date, lighting regimes are far from being optimised and standardised in aquaculture. The main limitations are the knowledge on lighting effect on fish and the complexity of testing the light protocols in rearing systems used commercially. To tackle this scientific and market opportunity, a new project started in 2013 with Philips Lighting, the world leading lighting manufacturer, with PhD student Ben Clockie. To carry out the scientific work, a new state of the art facility, the fish chronolab, has been built at the University of Stirling using the latest technological development in recirculation, environmental control and lighting systems using custom designed LED systems developed by Philips. Such facility will be used for the coming 3 years to investigate how fish perceive light and determine the most biologically efficient lighting regimes to improve fish performances and welfare. The main focus of the project is on salmon for the first year, followed in the next years by development in other commercially important species in Europe and overseas. The project also involves full commercial scale trials with leading aquaculture companies.

