COST ACTION FA1304: SWIMMING OF FISH AND IMPLICATIONS FOR MIGRATION AND AQUACULTURE (FITFISH)

A. P. Palstra[a]*, J.V. Planas[b]

[a] Institute for Marine Resources and Ecosystem Studies (IMARES), Wageningen University and Research Centre, Korringaweg 5, 4401 NT Yerseke, The Netherlands
[b] Departament de Fisiologia i Immunologia, Facultat de Biologia, Universitat de Barcelona and Institut de Biomedicina de la Universitat de Barcelona (IBUB), Barcelona, Spain
Email: arjan.palstra@wur.nl

Summary

Aquaculture plays an important role in securing our future by supplying the increasing demands for animal protein. Poor fish health and welfare are a challenge for the growth of aquaculture. Aquaculture should aim to produce fish that are physically fit and robust (i.e. having the ability to maintain homeostasis under changing conditions and the capacity to mount a strong disease resistance). For fish, swimming is an essential characteristic that is intimately linked to their ability to develop, survive, grow and reproduce successfully. Current farming conditions, however, often do not allow fish to fully display their normal swimming behaviour. Therefore, farmed fish cannot experience the physiological benefits that swimming gives their wild counterparts. Exercise represents a tool in aquaculture to improve growth, health, welfare and filet quality (Jobling et al., 1993; Davison, 1997; Palstra & Planas, 2011; 2013).

The level of exercise for aquaculture fish is optimal at swimming speeds where the fish reap the benefits of the exercise without wasting energy on aggressive behavior (at speeds which are too low) or using excessive energy for swimming (at speeds which are too high). This level of exercise depends on the species, life-stage and the physiological fitness of the fish; on environmental conditions (water quality, oxygen); on the system design (RAS or flow through, tanks or raceways) and on how exercise is induced which can be accomplished by creating a current or by using the optomotor response of the fish (Herbert, 2013). Optimal exercise may be beneficial not only for athletic fish but also for species that are less known for their swimming abilities in their natural habitat. Species-specific exercise protocols that vary in duration and intensity may, therefore, be developed. Effects of optimal exercise may include: 1) Improved feeding efficiency, growth rates and skeletal muscle mass; 2) Changes in muscle composition leading to higher flesh quality; 3) Increased survival by increased robustness or fitness; 4) Increased welfare by lowered stress; 5) Improved immune capacity, and 6) Control of reproduction. Furthermore, swimming exercise can be applied to select fish on the basis of their swimming performance e.g. to select out weak or abnormal fish.

"FitFish" aims to promote research on the swimming physiology of fish and to increase fundamental knowledge on exercise mechanisms as well as applied knowledge that can be used for implementation of exercise for aquaculture purposes, e.g. swimming to optimise production. In 2010, we organised the first FitFish workshop in Barcelona and related symposia at the Int. Congress on the Biology of Fish (Barcelona 2010; Madison 2012; Edinburgh 2014). A special issue of the journal "Fish Physiology and Biochemistry" was edited as well as the book entitled "Swimming Physiology of Fish. Towards using exercise to farm fit fish in sustainable aquaculture" (Springer). Recently, a Frontiers special issue was edited on the "Physiological adaptations to swimming in fish". In April 2014, the COST Action FA1304 on the swimming of fish and implications for migration and aquaculture (www.fitfish.eu) was started. Already 23 countries are participating in this network action that has the objective to further develop the research network in which fish swimming in the wild and in aquaculture is studied for the first time under a multidisciplinary perspective. The Action will provide the basis for technological breakthroughs (e.g. more accurate monitoring of migrant fish; design of exercise-"friendly" fish farming facilities), for establishing swimming as an essential

factor determining welfare and for demonstrating that swimming can benefit quality production. The Action will add value to independent, nationally funded research activities by providing the means to exchange information, promote industrial activities and influence policies at a European level. Activities in FITFISH also include the training and exchange of early stage researchers in the area.

At AE2015 in Rotterdam a congress session will be organised on swimming to optimise production which is open for congress participants. This session is convened and chaired by Dr. Harald Takle and Dr. Helgi Thorarensen, leaders of the COST Action's Working Group 3 "Exercise in Aquaculture". The aim of this WG is to gather scientific information on swimming of aquaculture fish, to identify potential gaps in our knowledge for targeting future research efforts and to design optimal swimming protocols for specific species and conditions. After the session there will be a WG 3 meeting for COST participants and invitees only with the purpose to transfer knowledge of the effects of exercise to European fish farmers and discuss the opportunities for implementation of swimming in current aquaculture practices.

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